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Circle 10 on Reader Service Card, ENR, March 1968

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From its welded steel nose to the spar-web construction of its wing roots, the Fairchild C-124A Aircraft Transport is built to stand the gulf of loading large numbers of combat troops to rough, postage-stamp size runways.

To give the C-124 the stamina it has, Fairchild had to find ways of doing away with weight penalty. A couple of these structural secrets are included in pictures of the aircraft delivered by Goodyear Aircraft Corporation.

Take the front entrance door panel, for example. Originally designed to be built of conventional materials, Goodyear Aircraft was later asked to engineer a new door at Bunkles. This construction of honeycomb-metal-core-bonded-to-aluminum not only contributed

weight savings, but increased the strength as well. High atop the tail fin, you find other examples of how Goodyear Aircraft's use of bonded aluminum in the cap of vertical laminated plastic and a fin panel of fiber glass structural aircraft plastic for electromagnetic transparency without weight penalty is another field in which Goodyear Aircraft has carried experience and facilities.

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This block contains several hand-drawn sketches of mechanical linkages. At the top left, there is a sketch of a crank-rocker mechanism with a slider. Below it, a more complex linkage is shown with multiple links and joints. To the right, there is a sketch of a slider-crank mechanism. At the bottom, there are two more sketches: one of a slider-crank mechanism and another of a more complex linkage. The sketches are labeled with handwritten text: 'Crank-rocker', 'Slider-crank', 'Crank-rocker', 'Slider-crank', and 'Crank-rocker'.

"There shall be songs!" de Vries declared. If the scrumptiousness be not for me, 'tis for some other. "Today we have them, winged and like de Vries, keep trying to impose on the world with it. With the same spirit EMD research continues to supply today's new and better research with new and better scientific instruments." *continued*

It pays to ask for



AVIATION CALENDAR

APRIL 1968 • MARCH 5, 1968
Vol. 48, No. 12[illegible]

These results are independent from a large number of previous studies. For example, in a study of 1000 patients with a history of myocardial infarction, the authors found that the risk of death was significantly higher in patients with a history of myocardial infarction than in patients without a history of myocardial infarction. This finding is consistent with the results of the present study, which found that the risk of death was significantly higher in patients with a history of myocardial infarction than in patients without a history of myocardial infarction.

JOURNAL OF CLIMATE, March 2004

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*May 12, 1998, Vol. 25, No. 10

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Free Perspective on the Aircraft Industry 39

COVER: Yesterday's sleekest of Martin's latest version of its Mustang, ground-to-ground tactical fighter, the F4U-100. Outstanding external feature of the new model is a tapered nose section, probably incorporated to provide greater fuel capacity. For further details and preview, see page 77

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AVIATION WEEK • MARCH 5, 1956 • Vol. 34, No. 19
Number APR and APC

True Perspective on

Also see William Allen, president of Boeing Airplane Co. detailed statements in a column, Armed Forces Edition, while one of the best interviews we have ever heard of the role Boeing of the people's spiritual, political and social values and the American people and this government in the development of the national plan in Mr. Allen's column—Robert Herli

What I have to say really applies to the entire industry, but I don't purport to speak for the industry. I am speaking only for the Boeing Co.

Let's look at the background for just a moment. We know the Russians have nuclear weapons. We feel, and I believe it is generally recognized, that our security depends on our ability to retaliate.

Now, as far as equipment is concerned, namely, the equipment that will be used to carry the weapons to retaliate, as it stands today, it is pretty laughable. The Boeing Airplane Co.

The B-47? If we had something happen today, the B-47 would principally carry the load, supplemented by our KC-97 tankers. If something happens in the future, in the foreseeable future, it will be the B-52 again supplemented by our jet tankers.

In other words if we have a replacement, it possibly lies in the equipment that we use and the people who operate that equipment, to carry the tanks, to carry the weapons, the bombs.

Now, you have read the statements. I am sure of our man people in which they have said that they feel that the Russians have passed on qualitatively and that they are narrowing the gap qualitatively. That is beyond any knowledge.

I only can say that I have great confidence in the people who make those statements. Gen. Twining, Chief of Staff, Vice Chief of Staff, Gen. White, Gen. LeMay, Gen. Power. In this interesting paper, I read where Gen. Twining testified before the Senate Armed Services Committee, and the statement said:

"Gen. Twining and Rosen have long since passed on in the quarters of airplanes and in regard to moving the United States' margin of superiority in quality. The Air Force Chief of Staff told the Senate Armed Services Committee his real concern was with the Soviet attempt to close the quality gap by greatly increasing their research and development program."

Now I feel, and I am sure our industry does, that if we are to preserve our security, it is essential that we preserve our technical superiority, as I have it.

Gen. Kenney, who was Gen. MacArthur's air general in the last war, summed it up. I think, very well in his remarkable fashion, when he said, "Air power is like poker. The second best hand is some time over it. It will cost you dough and you are losing."

Now, how do we maintain that superiority in equipment? The Government of course has chosen to do it in the American way, as only on private enterprise. In my opinion, that is the proper way and the only way we will ever preserve it. If we try to do it through direct Government construction—and I don't say this casually. It has been tried and it didn't work. And the minute we get into those complexities and severe competition under the industry, quality will suffer. Our chief complaint at one time expressed it this way: We never do as well as when we realize that our best

was not be good enough, meaning that the Boeing Co. never does as good a job as it does when it realizes that its competitors are after the same business and our best man will be good enough to get it.

The minute we get away from that, qualitatively we are lost.

Now what does the Boeing Co. have that is so valuable to the American people? There has been talk of facilities. We have done the best we could on facilities. But facilities are meaningless without people who have the know-how.

I refer back to the cancellation of our contracts at the end of the last war. We had no business to support our organization. But we all recognized that it was essential if we were to continue in business that we pursue as large a nucleus as possible of that know-how that we had built up over the past 25 years.

We preserved that nucleus by going out and reconstructing the construction of 30 B-29 Superfortresses, without any orders. We sold them. We had orders to them. But it kept our organization, a small nucleus, employed and together. And thus as we went along and developed business and Korea came along, we had what it took to do the job.

Let's take the Wichita plant, for example. This is a large Government plant, and then we have a small private plant, one of our own, next door. At the end of the war the Government closed down that plant but that (industrial with head). They took all the equipment, parts and so forth, and sold them as junk.

We took our organization and slung it back into our own little plant down there and we got parts to build for the commercial market, and we kept it alive. When the B-47 came along, we had an organization that could move into that Government plant, relocate it and it has now produced over 1,200 B-47s.

That is the precious thing, an organization that knows how to do it.

Now, before I come down here I had an anxious made of how large an organization would we have to maintain in order to be capable of building and designing the present modern bomber. I gave this testimony before the President's Commission in 1947, and at the time, based upon the product of Boeing—our production in the B-29s and B-50s and so forth—I came to the conclusion that it would take 15,000 people in order for us to preserve a nucleus of what it took. Our analysis today shows 23,000 people. The B-52 has over 100,000 people. In order to design and construct that, it takes hundreds of different types of skills. It takes scientists, it takes laborers, and so on.

Now if I want to really keep myself awake at night, I ask myself the question: How are we going to preserve that nucleus if we have another 1947? Or how are we going to preserve it if we don't click and continue to get the business that is necessary to support it?

Now, that then brings me to this question and the one I would like to have you consider. How, strong, how capable do we want concerns like the Boeing Co. to be? That is the problem to be answered by the American people. And I am going to point out in a few words here that I think up to this point these have been sufficient attention given to it.

the Aircraft Industry

I submit to the committee: Not only think about whether we are making too much money, but ask yourselves whether we are making enough in light of our responsibilities. Not money to pass to the stockholders. Our record speaks for itself on that. What have we done with our money? By and large, we compare very favorably with industry generally. Whereas we have retained approximately 75% of our earnings in order to put us in a position to do a better job. Industry generally retains about 45% as compared with our 75.

But if we had greater earnings, we could do a better job. We would pour that money into laborer's pay, like we are doing now with what we have, into developing new materials, like we did with the 707, which has saved the Government time, present time and money.

And on that point I want to cover this. I have gotten the impression that the fact that a company does practically all of its business with the Government is a mark against it. I want to submit to you that it should be a mark in our favor, and I will tell you why.

We have declared, the Boeing Co. has declared itself to the United States Government, and I am proud of it. I can point out to you instance after instance where we could have sold to others to our gain and were requested not to do so or prohibited from doing so because it was decided that it would be better for us to concentrate our efforts on Government business or because they didn't want the article to get into other hands.

Now, we are now entering the commercial business. That will benefit the Government. It will give us greater stability, we hope. But we only entered it after we satisfied the Air Force that we could do it without in any way jeopardizing our ability to perform our military contracts. That took a year. The Air Force took one year to consider that and finally agreed that we had the capacity and we had the equipment to do the job without interfering with the Government's work.

We are not in and out of the aircraft business, in the Government aircraft business. If you really want to make money in the aircraft business, you only perform during war.

Let me illustrate what I mean. We lost money prior to World War II as developing the B-47 and other aircraft. We lost money in World War II when we contracted. I can cite you instance after instance where we subcontracted parts, we will say, of the B-29 to a company that had had good earnings commercially prior to the war, and therefore it had a good tax base. Under its subcontract it keeps a fair share of its profits. With no tax base, we pay out 90%. The same article being produced by a company in our design keeps several times the dollar on the same work that we would have kept had we done the work.

What does it amount to? We build up no strength. Why is it that our net worth is so low? We have never had an opportunity to make money.

Now, what happened after the war? No work. We lost money during the base years, again. Excess profits tax comes along in Korea and we pay out the maximum.

In other words, it is almost—it looks like it has been arranged so that companies like the Boeing Co. can't build up strength.

In essence, with the responsibilities we have, I feel

... strongly that we are not being given the opportunity profit-wise to develop the strength that is essential to us.

Take a look at 1952. Over \$700 million worth of business. We end up with \$14 million and the Remington Board comes along and says, "That is too much money." Pick up the newspaper, and you read of commercial companies making, after taxes, \$100 million, \$200 million, and even over \$1 billion. And what are their percentages after taxes? Eight, 9% even more. But when we made two-point something per cent after taxes, the Remington Board said, "That is too much."

Long in light of our responsibilities that we have to the American people it is not only shocking and appalling, it is sickening. I don't very strongly about it.

Now, what can be done about it?

First, before I say that, I want to cover the matter of subcontracting. I think people already have. But there, again, is a good demonstration of the company that is dedicated and dedicates itself to the Government and one who enters defense business only if it would appear appropriate at the time. I make the categorical statement that we have also looked first to the Government to determine what is best for us as well. And at last it has something to say about it, we always will.

But don't question the Boeing Co. because at this moment our work is almost entirely Government. That should be a mark in our favor. It could have been otherwise. But it would not have been to the benefit of the United States Government for it to be otherwise.

Now, what is needed in any opinion is a statement of Government policy on the matter, either as legislation or otherwise.

Mr. Vinson did that once in the Vinson-Trammell Act, and he said a profit rate of 12%.

To my knowledge, we have never even approached that. But a statement of policy is needed from the congressional body, because first it down to the way it works, where we go—and I don't say this critically—it is the way it naturally would work. We go to Wright Field to negotiate a contract. The negotiator has instructions to negotiate in the Government and get that profit rate down as low as he can. Our industry is highly competitive. We in effect take the rate that it pays to us.

Now, although I think this hearing is a fine thing, you can be sure that the fact that you are looking at profits will have a very definite effect upon the profit rate that we will be allowed. In other words, the negotiator, as up, is going to say, "I am not going to have General looking down on the back of my neck, and having I give some company too much money." And we don't want that. All we want is something that is fair and reasonable, particularly in the light of our responsibilities. And I submit to you in all sincerity that what we have been given up to this point is insufficient.

Mr. Herbert. Thank you very much, Mr. Allen. We appreciate your statement. It is at well timed and well founded.

Mr. Butler: Mr. Allen, that was a magnificent statement. I think you were performing a tremendous service to not only the United States but for the entire free world, because if it was not for Boeing today, perhaps there would be no free world.

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WHO'S WHERE

In the Front Office

Group Capt. S. G. Tolos, military requirements adviser, Bristol Aero Engines Ltd.

Edith S. Elder of Pittsburgh and Walter W. Conley Jr. of Los Angeles, elected directors of American Airlines, Inc.

W. A. Fairman, president of United Air Lines, elected a director of the Canadian Air and Inland Co.

Ray W. Barstow appointed controller of Convair Division of General Dynamics Corp., succeeding the late Dwight T. Fisher.

Edward N. Townsend Jr., named vice president of Children's Luggage American, Inc., in Washington, D. C.

Terrell C. Deschamps, president of Western Air Lines, Inc., and John L. Walter, vice president of Trans World Air Lines, Inc., named directors of the Transportation Assurance of America.

Honors and Elections

Das Institute, chairman of the Popular Sub-Committee of the National Advisory Committee for Aeronautics. It is a chief development: Aerospace Operations, Aircraft Division, General Motors Corp.

Henry F. Guggenheim, named chief editor-in-chief of Aviation by National Aeronautics Assn.

Dr. Nicholas J. Hall, awarded the Medal of the University of Liège (Belgium), for contributions to aerodynamic computation as aerodynamic among NATO nations and research in aerodynamic science. He is NATO aerodynamic consultant and head of the department of aerodynamic engineering, Polytechnic Institute of Brooklyn, N. Y.

Dr. W. Duncan Ramey, now Robert H. Goddard Professor of Jet Propulsion, California Institute of Technology.

Changes

Fred L. Doherty, chief engineer, Hawk engine Engineering Division, McDonnell Aircraft Corp., succeeding Charles B. Herkamp, who has joined Fairchild Engine & Airplane Corp.

Arthur W. Robinson, manager, systems engineering, General Electric Co. a Special Defense Projects Department, also Robert E. Robinson, manager, instrumentation engineering, John O. Brown, manager, systems engineering, and Kenneth C. Bernheim, manager, electrical engineering, General Electric Co.

Richard Stokholm, formerly editorial director of American Aviation Publications, is now with the advanced propulsion systems section, Aircraft Division, General Electric Co. in Hamilton, Ohio.

Dennis J. Philbin, supervisor of assembly section, Trans World Airlines.

E. A. Lewis, manager, research and development, Central Staff Research & Development, North Division, Thompson Products Inc., Walter R. Chapman, manager, development and design, and Joseph C. Wells, manager, jet, transport-engineering section.

Charles J. Kamman, head of product and applications design section, Aircraft Division, General Electric Co.

INDUSTRY OBSERVER

► Boeing B-52 crash on Feb. 23 during Wild Weather Wing training operations from Castle AFB, Calif., was caused by an electrical system malfunction. In an official statement, USAF and a portion of the B-52 fleet has been grounded and the remainder will be "as soon as corrective action can be completed."

► Bristol Aeroplane Co. Ltd. has a project to develop a Mach 2.2 research aircraft that is new in the design stage. Plans designation is the Bristol 32.

► Lockheed is pushing an all-weather version of the F-105A equipped with a high-speed radar and armed with two Falcon missiles as an anti-defense interceptor for Air Defense Command.

► Convair is contracting with Howard Hughes on a medium-range jet transport design utilizing four General Electric JT7 turbojets. The Convair proposal would be competitive for the Lockheed Electra in the medium-range field. United Air Lines is also interested because they want to standardize their new maintenance system on turbojet engines rather than handle both turbojet and turbojet.

► Air Defense Command pilots will get their newest missile practice with the Topdog—a version of the Douglas Dag Dog missile that is fully-identical to the real missile but has only a spotting charge of explosive as the warhead instead of the nuclear explosive of the operational missile.

► Martin P3B SeaBreeze jet flying boat will be powered by Pratt & Whitney JT7 turbojets in the 15,000 B. thrust class as in production version. Both prototypes used the Allison T71 plus turbofans.

► Three Canadian firms will manufacture the U. S. developed Sparrow Sparrow jet four missile for the Royal Canadian Air Force. The Sparrow will replace the Canadian-designed Vulture Glove (AW No. 25, p. 7) in armament in the Avro CF-100 all-weather interceptor. The Vulture Glove was abandoned after five years of development because of its lack of range. Preliminary work on the Sparrow already has begun. A. V. Roe Canada Ltd., Toronto, is in charge of the project. Canadian Ltd., Montreal, will make the missile frame, Canadian Westinghouse Co. Ltd., Hamilton, will make the electronic gear for the guidance system.

► Canadian Ltd., Montreal, is negotiating the sale of its Sabre 5 aircraft powered with the Avro Canada 14 engine to the West German Air Force. Peter Ruppel, Canadian Ltd., vice president, has been in Bonn discussing the sale.

► Boeing Aerospace Co. is scheduled to display full-scale interior mockup of its 747 jet transport at New York this month. Five-strut seating will be featured, with Boeing designed chairs of unusual modernistic design. William Lerner, Tri-State Aerospace, industrial designer, says representing mockup construction for Boeing.

► Cessna is now selling out a Model 180 twin engine executive plane, every working day. Sales rate as the Model 180 reached 36 a month for last December.

► Arroyo is getting three of Aero Design & Engineering Corp.'s new Super Aero Commander 680's, designated L-26C.

► Canadian Navy is getting about 40 McDonnell F2H-3 Banshees for use as a seaplane all-weather carrier fighters.

► Bristol Model 100 Britannia are being modified to convert trouble circumvented with stiffening of controls at high altitudes and low temperatures.

► New Licensing turbojet will be the L800 by T55, which is a scaled up version of Lycoming's 850 hp. T55. The T55 will feature the same compressor layout as that of the T55, including several stall stages followed by a centrifugal stage, compact combustion system, low power input and very economical use of critical materials which characterize the T55.



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WILL BRING YOU BOEING JET SERVICE

Fleet of Boeing jets like the plane pictured above have been ordered in all sorts of these major airlines. Delivery of the big, swift 510,680 mph aircraft will begin late in 1970, and the first ones will be in scheduled service a few months after.

These airlines have chosen Boeing jets because they know what they're getting. Boeing's 707 prototype jet airplane has been flying for well over a year—proving its performance in more than 500 hours of flight tests.

Pilots and officials of these airlines

have flown the 707. They have experienced its smoothness at ease of handling and excellent flight characteristics—the extraordinary smoothness and quiet at its role. They have discovered how economical it is to operate and how its design makes maintenance simple and quick. They know its speed and range—and from paper evaluations but from actual flight records.

In October the Boeing 707 crossed the continental four-day Seattle to Washington, D. C., and return—in 5 hours 45 minutes! That's an indication

of the schedule time you can expect aboard the new Boeing. Boeing jets will be first in service because only Boeing had enough faith in jet transports to build a prototype with its own money—and enough experience in producing big aircraft to carry the job through.

Over a period of nearly 40 years, Boeing has played a leadership in aviation research design engineering, and as the ability to produce and deliver large numbers of high-performance aircraft on schedule.

BOEING

Washington Roundup

Ike's Effect on Defense

President Eisenhower's decision to seek re-election will have a major effect on the military assistance situation in general. The fact that he will seek and probably get a second term in the White House will tend to guarantee the status quo in foreign policy, at a substantial, stable program spending relatively small sums to the program made by the Bureau.

During the military assistance from Portugal term will possibly change because the program is for the project of backing them in the military assistance program for another five years. On Capitol Hill it seems the prospect that no additional appropriations would be made in the summer in which President Eisenhower will be in the White House in 1961. The 70 program for Congress. Budgets for the military assistance program, which are generally viewed by the Bureau as being the product of the year in which the program is to be initiated, the Pentagon political climate of concern and get the facts directly to the President and the American people.

Continue Renegotiation?

Renegotiation Board chairmen are taking no position on the question of whether renegotiation should be continued. The statement came in executive session of the Joint Congressional Committee on Taxation.

But the Board's acting chairman, Thomas Coughlin, commented before the House Appropriations Committee. "If you take the President's message of last year as the point of departure, namely, the renegotiation that renegotiation be continued as long as only 50% of the budget goes to defense, I would say that if it takes as a paper point of departure and supported it could go on indefinitely. That is what the representatives of the Defense Department have said definitely. That then, we are talking about more than a year of renegotiating a military budget of less than 50% of the total budget."

On extending renegotiation to Dec. 31 of this year, Congress stipulated the study by the House Committee to determine if there should be a further extension.

Gardner Successor

There is little speculation at the Pentagon about a possible successor to T. G. Gardner who quit his post as USAF Assistant Secretary for R & D with a visit to Administration policies. Air Force officials are working with some trepidation for the vacuum to be filled, knowing almost with certainty that the chosen one will be considerably more conservative than his dramatic predecessor. Temporarily, Gardner's chair is being filled by Richard E. Houser, his former Deputy for Research. Houser has been in the Pentagon less than a year, is former general engineer at Edwards AFB.

Monroney Policy

Sen. Mike Monroney (D-OK) is making it a campaign theme for military assistance to get a hearing before the Senate Commerce-Agriculture Subcommittee as his legislative proposal to separate the Civil Aeronautics Administration from the Commerce Department. The Air Transport Act's solid opposition is still

known, and the scheduled airline's organization has been busy reworked out, with the latest tentative hearing date put back from May 5 to May 9. In the meantime Sen. Monroney is polling the AIA's members concerning an apparent effort to block the airline status.

An Airline Wars survey revealed that 42 out of 67 air lines support the AIA position. Both Trans World Airlines and Northwest Airlines take a neutral stand. Central Airlines, a local service carrier operating in Oklahoma, cast the only vote in favor of separation.

Safety Dots

You can discount press reports that USAF has changed a review label on its accident statistics. It is true that the Army safety reports are making it more difficult for members to get a random on the current accident and mishap rate, but the data will be released. The Air Force is confident despite a recent flurry of accidents, that the overall rate is not as high as it was at the last full year. USAF personnel in some cases are already making reports that the budget does not provide enough money for proper aircraft maintenance. However, where the budget limits, aircraft are provided as kept in flyable condition states they are not sent on operational missions.

Civil Defense to Defense?

Department of Defense does not want to take over the job of managing civil defense, as proposed in Senate bills pending in Congress. The House Government Operations Subcommittee on Military Matters headed by Rep. Carl Albert (D-Gold), has hearings underway which will continue for another two months.

Adm. Arthur B. Berke, Chief of Naval Operations, protested that going Defense Department responsibility for civil defense would simply "double" military spending. He said the Secretary of Defense should not be the "arbiter" between the civil and military programs.

Gen. Nathan T. Twining, USAF Chief of Staff, reacted that the best responsibility for civil defense should remain at the local level. "Nothing would be gained by transferring leadership to the Department of Defense," he said. "It would lead to an unhealthy concentration of decision-making."

Washington Airport

The decision on a site for a second Washington airport is now up to Congress, where the explosive problem was abruptly dropped on the Senate Commerce-Agriculture Subcommittee by Sen. S. Hollibaugh, Undersecretary of Commerce for Transportation.

Hollibaugh was strong in the subcommittee on his proposal for a local three-production report emphasis to be supported by private financing and the vigorous objection to a major national reconstruction for joint subcommittee. "We all ask for construction money, but the date of use it each give us a decision on a site. We'll also need your support, you know, before the appropriate committee."

The Senate group grabbed the ball and gave even advance that choice would be the nearby Burke, Va. site, which was the original CAA choice for years ago.

—Washington Staff



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HOW

Wilson's Order Threatens R&D Effort

Defense Secretary's shift of development authority provokes wide concern; Furnas delivers ultimatum.

By Claude Wirtz

Washington—The nation's military research and development effort faces a new threat in the Pentagon.

Angry at what appears to be the loss of more than half its authority and further erosion of the R&D position, Dr. Clifford C. Furnas, Assistant Secretary of Defense for Research and Development since last Dec. 5, has delivered an ultimatum to Defense Secretary Claude E. Wilson in an attempt to avert the new trend.

Dr. Furnas, a distinguished scientist and former director of General Atomic's Laboratories, has told Wilson he will leave his post unless Wilson returns to his office no later than Feb. 21 to Frank D. Newberry, Assistant Secretary of Defense for Applications Engineering.

The change, greatly increasing Newberry's power over R&D projects, is described like a bombshell in the Pentagon. In a memorandum to the service secretaries, Wilson announced that he is delegating responsibility for the review and approval of the technical aspects of development projects to Newberry's office.

The project, Wilson said, is "preliminary to more effective review."

Called Backward Step

Isolated members of both military and civilian R&D personnel saw use of expediency in view of the long postwar battle to separate production experts from scientists with scientific adroitness.

That decision, a top Air Force official told Associated Press, goes counter to everything we have been trying to do. If the memorandum seems what it is, USAF has been putting even possible effect into the arguments of R&D from production-minded people. This is a step backward.

USAF Secretary Donald A. Quarles, who paraded Dr. Furnas in the Defense R&D post, was not directly involved in the new battle, but it is widely known that Quarles fought successfully against Newberry's effort to invade the development field during his tenure in the office.

Dr. Furnas' threat to quit followed closely the resignation of USAF's Assistant Secretary for Research and Development, Thomas Godfrey (AW, Feb. 13, p. 28). There was speculation that if Dr. Furnas does leave, his departure will create an even more critical situa-

tion than the departure of Godfrey, who has bluntly told the press and Congress that he quit in protest against Defense Department's attitude toward R&D.

Godfrey since has been a witness to four Congressional committees and scheduled to make more important appearances before investigations into the Defense Department—particularly its guided missile programs. There was speculation that Wilson will make a strong bid to keep Dr. Furnas on his staff, at least partly to prevent him from joining Godfrey as a technically competent witness who would embarrass the Department's performance.

Expansion of Newberry's power over development follows several months of deep concern over the evident success of the Services in shortening their development and production cycles on new weapons. Only two days before the change, Dr. Herbert R. Townsend, USAF Chief of Staff, warned Congress that no one being captured by the Soviets in R&D (AW Feb. 27, p. 20).

Concern at All Levels

R&D workers at all levels feel that the new power given Newberry will further erode development team autonomy it provides a new office that must be created mid-way in a team difficult to succeed that a project has merit. Also the new organization does not mesh with the setup in the military services leaving the Defense Department out of gear with the armed forces' engineers' jobs.

In addition, there is the fact that development work sometimes involves the need for more basic research. A recent and well-known example is the work done in the area of solid-state devices, the design of more efficient than the prototype stage—such as the General F-300—but solid-state projects that otherwise would have been failures.

Adding to the team confusion and a source of particular irritation to Dr. Furnas is the fact that the memorandum ordering the change was circulated to the service secretaries before it came to his attention. The memo made a point of this in his letter to Wilson.

Wilson's Memorandum

One report said Dr. Furnas did not know about the change until he read it in a Washington newspaper. A Defense Department spokesman denied this, saying that the Assistant Secretary and his people had been advised several times before the memorandum was drafted.

Key paragraph from the Wilson memorandum, said:



NEWBERRY: Vice Power



WILSON: In the Middle



FURNAS: Threat to Regain

"This Appalachian engineering responsibility covers all development projects submitted for review and approval to the Office of the Secretary of Defense by the Assistant Secretary, including development projects inherent in support of annual budget estimates, annual appropriations requests and interim programming proposals. Such development projects include projects that are inherently of a research or exploratory nature, such as projects whose planned purpose is to explore a field of knowledge in search of new information, to study new concepts that may result in the development of new, or improved, material, or to prove the feasibility of new ideas or principles, and whose purpose and currently planned funding does not provide for development of a complete unit or component for service use."

This statement was interpreted to mean literally that Dr. Farnes will have no personal responsibility over past research and exploratory development hardware and that Newbury will have no control as soon as weapons have been involved.

Opposes Other Recommendations

It was pointed out that about 50% of our mission all positive studies of the R & D problem have been released in their development of this policy.

For example, a House subcommittee study of military R & D in 1954, found that some of the nation's top scientists explained "the great need for intensive research and development operations from every of the standard products and equipment developed in the past to present and to future."

So far as USAF is concerned, a spokesman pointed out that the very creation of two committees for research and development and for material was

a step intended to insure separation of the functions.

Compeller's Role

"The Air Force, he told *Air Force Week*, "concentrates the equal responsibility for R & D and production. It is a joint job and at every opportunity it becomes concentrated in the main production job. This new order will make R & D subsequent again. It has been too much so in the past."

Apparently an important factor in the situation is an attempt to increase indirectly the control of funds by W. L. McNell, Defense Department Comptroller. McNell's memorandum says that fiscal procedures on development projects are to be worked out in the future by McNell and Newbury, with no mention of a role for Dr. Farnes. The process is to follow another Wilson memorandum, dated June 10, 1955.

The 1955 memo updates that Newbury has responsibility for recommending certain requests for allocation of funds, including appropriations. In the 1955 memo this is restricted to obligations for production and procurement. It was that request from the military departments must be sent to McNell's office and that he will set on recommendations from Newbury.

The addition of development projects to production and procurement in this process obviously gives Newbury and McNell the power to decide which scientific breakthroughs will be exploited, even in the context of prototype development.

This fact is a source of distrust in the R & D staff in Defense as well as the military services. The old Research and Development Board was replaced with the creation of Dr. Farnes' office study they also study with new purposes to provide contact with the organiza-

'Crash' Programs

In his recent assignment from the Air Force as Assistant Secretary for Research and Development, Ernest Carlson called for a "crash" program to advance the U.S. ballistic missile program. Carlson had argued with a schedule while in office but was unable to win Defense Department agreement. It is a crash program that the Kennans have a "crash" missile program.

The Department's more conservative attitude has been expressed by Frank D. Newbury, Assistant Secretary for Applied Systems Engineering, who has been given new power over R & D. About a year ago, Newbury told a House subcommittee on Appropriations:

"Experience has shown that such programs, where large quantity production has been contemplated, can be very expensive, in time and cost, unless exceptional compensating payment is made in estimating the risks. As a rule these crash programs have not paid off."

tion and power to spend money to fill strategic needs with atomic weapons.

Aim May Be Frustrated

There is a strong feeling that this aim will be frustrated if the Assistant Secretary of Defense for R & D is confined to past research and exploration.

In reply to queries from *Air Force Week*, a Defense Department spokesman said that the information about the new order.

• Newbury is given program control, including fiscal control, over development projects in an effort to make sure they stay within the new program.

• Major use of the new order is to "dramatize development" and speed development by concentrating on fewer projects with great promise.

• For better or for ill, Dr. Farnes' responsibilities, the spokesman said, the new order may even broaden activity in the research field, over the R & D office is viewed as direct responsibility for continuation of development work.

• The Department spokesman noted that Defense does not agree with the House Committee's recommendation that the R & D and applications programming offices should be combined (AW Jan 25, p. 34).

Upon issuance of the order giving Newbury wider power over development, Wilson departed for a Florida vacation. He was due back at the Pentagon office the letter to Dr. Farnes and a possible showdown with his critics R & D staff.

Enlightenment of Newbury's role to take in greater responsibility for



Temco Trainer

First test on impact at Temco Aircraft Corp.'s new model 51 light and maneuverable trainer (AW Jan 25, p. 34). Wing mounted instead of fuselage, control gear, ground-protection boots. Trainer powered by a 140-hp. Lycoming GSO 400 A1A, has a cruising speed of 174 knots.

development led to more speculation in Washington that he is being considered seriously for the unenviable post of "chief" over the guided missile program. However, Wilson has said that he has four or five men under consideration for the post and he is expected at the time that all of them were outside the present Defense Department organization.

Two main two-sided interferences in R & D by production men may make clear last September in an *Air Force Week* session. "Perhaps," observers pointed out. At that time William H. Martin, former member to Newbury as assistant director of R & D for the Army. He is a retired vice president of the Telephone Laboratories, and had been with Newbury about two years.

One Pentagon source close to the problem, and the Wilson regime now has no more uncertainty, has to be a serious matter. However, that is done up with no regard for the job to be done and what we have learned by experience."

Newbury's Views

Additional background can be found in Newbury's testimony on Capitol Hill during hearings on the Fiscal 1956 budget. Before the House Appropriations subcommittee, Newbury admitted it is not practicable to transfer staff members of a project from R & D to applications engineering during the progress of the work.

He repeatedly made it clear that he is opposed to joint responsibility and that "additional program can be made to the desirable reduction of this area of joint responsibility."

On the subject of resources, Newbury said a year ago that he could not cite any clear-cut example of his at-

ter, having small ones. He added that his office is most effective when it worked personally and directly with the project. By this method, he said, his office had made careful suggestions that reduced the cost of development.

Earlier, at that time accepting the post previously held by Dr. Farnes, stated before the House subcommittee that the R & D office had made "significant departmental modifications of

current and planned programs." He went on to list eight examples, including coordination of Army and Marine requirements for an observation aircraft, elimination of false duplicating electronic test proposals and modification of two air navigation projects.

Opposed KC-135

Newbury, on the other hand, said closed at the hearing that his office as a "contribution" to the budget review had recommended that the Boeing KC-135 off-shore program be discontinued and that the plane be replaced with a converted B-36 or B-52. His office was unsuccessful in that effort but did manage to dissuade the Navy from ordering eight Martin PM-8 Sea Kings of Hong Kong. Two have been built thus far.

Another chapter of Newbury's history in the Defense Department was his refusal last week to sign off on a visa to bring about manufacturing of aircraft before engines.

In this case, he proposed setting up rigid timing ratings and engine distributors. He also cited a program that would provide for final development and evaluation of only one engine out of the designs offered in an competition (AW Jan 24, 1955, p. 35).

Infrared and infrared related with identification. The Aircraft Industries Association and individual engine makers voiced strong opposition and pointed out that an engine requires more time to be worked out because of the failure of one engine project, it is an alternative power unit is available. A compromise finally was reached. In effect, it was a deal for Newbury.

There was general agreement in R & D circles that Newbury, given authority over development project, will oppose

Newbury's Job

Ever since its establishment in the Department of Defense, there has been a good deal of speculation on the exact nature of the Assistant Secretary for Applied Systems Engineering. Assistant Secretary Frank D. Newbury himself has been quoted as saying when he took the office in 1953, that he would have to learn what the job was in his first day.

Before a 1954 House subcommittee on government operations, known as the Birmaham Committee, the following exchange took place between Ernest Carlson, then USAF Special Assistant for R & E, and Michael P. Wilson, the committee's staff director.

Mr. Carlson: Frank, I would not know how to interpret my setup to include right down through the bottom of the organization a reference of this systems engineering philosophy. We do have groups of people that might perform the function that is usually done by the Assistant Secretary, Executive Secretary's duties, but I just would not know how to organize the Air Force to do this.

Mr. Wilson: As I understand the office, on the level of the Secretary of Defense, the Assistant Secretary for Applied Systems Engineering is there to act as the coordinator of the development to get their ideas into production in a form that is not so much the Assistant Secretary for Applied Systems Engineering as they are.

Mr. Wilson: We do not know ourselves.

many new ideas, multiple approaches, but progress and pioneering of equipment considered essential by the scientists were seeing to exploit break-throughs.

This viewpoint is supported by the testimony of nonproliferation experts and a long series of reports to Congress and the White House on military R & D. These witnesses have agreed that radical new weapons ideas must be pushed by pure scientists because military men and production experts impede progress in this field. And, they say, the radical ideas must be carried up to the point of technical and experimental demonstration.

Said Dr. James R. Killam Jr., president of the Massachusetts Institute of Technology:

"Many of the technological advances that helped to win the last war, such as radar, the atom bomb, the proximity fuse, were the result of the team-work methods of outstanding scientific scientists and engineers who had always been free of any inhibiting organizations and organizations."

Nowlan, on the contrary, has testified that his office is eager to introduce more planning and management into development. Part of his rationale, he believes, is to cut the types and sizes of weapons and equipment with great complexity and standardization. All these are anathema to the R & D expert, who holds that scientific progress is impossible in that kind of atmosphere.

Newbury is 74 years old. He retired as a vice-president of Westinghouse Electric Corp. in 1945 and was called to the Pentagon to head the application engineering office when it was created in 1951. An engineering graduate of Cornell, he spent his entire 45-year career with Westinghouse.

20

Profits Probe May Lead to New Policy

By Katherine Johnson

Washington—The goal of hearings on the profits and costs of aerospace manufacturers is a Congressional request recommending a government policy for doing business with private firms built up almost exclusively by government financing, according to Rep. Edward Herbert (D-La.), chairman of the House Armed Services Subcommittee conducting the investigations.

He told *Airways Week* there still is a question as to whether the recommendations he will be followed up by legislation or simply stand as guidelines for the military services to follow in procurement. Herbert also expressed doubt as to the possibility of a status-area report.

Opinion on the subcommittee varies from the suggestion of Sen. George Miller (D-Calif.) that the National Advisory Committee for Aeronautics be expanded to handle aircraft development to a point where it is limited only to industry competition for production in the years held by special subcontractors. Republicans that attack nonbusiness should have responsibility to commercial businesses on savings.

USAF, Navy to Testify

Herbert hopes to send up the hearings this week on the 11 major defense firms. Much of the specific data supplied by the companies is known to a subcommittee questionnaire already he received in the second and published. Testimony from Air Force and Navy will finish the picture.

"The picture is already clear," he said. He added that there could be no further hearing on aircraft engine or equipment problems.

At the hearings, Herbert and other subcommittee members focused on the growth of five firms on government business. Douglas Aircraft Co. developed from an original \$15,000 private investment in 1920 to a present net worth of \$134 million and McDonnell Aircraft Corp., developed from a private investment of \$10,000 in 1919 to a present net worth of \$74 million. McDonnell's net worth in 1947 was \$949,000.

Douglas and McDonnell were purchased by Boeing Aircraft Co., the Martin Co., Fairchild Engine and Airplane Corp. and General Aircraft Engineering Corp., and North American Aviation, Inc.

Facts that have been emphasized in subcommittee hearings and in which

recommendations will be made in a report are:

- **Isolated price controls.** The audits showed manufacturers on profits above the target price versus from 95% to the government and 5% to the company at a 75 to 25 ratio.

- **Isolated business, joint companies.** Douglas and McDonnell—joint non-business. Glenn-Baker, North American, Martin, Fairchild, General—also made similar cost changes against government contracts for such private companies. Policy since, General allows no losses to officers, Fairchild because it merged 16% of sales for top management and only 5% for lower employees. Air Force has ruled to disallow costs for inactive payments, Navy has not.

- **Managed salaries.** These vary widely within the industry, for persons holding comparable positions. The total pay management is also very wide. Some firms with the highest net values have the lowest management costs.

- **Military officers.** Herbert has been especially skeptical that military officers employed by aircraft companies do not avoid salaries with their former services. Fairchild, which has employed as former top military personnel, was the main target for critics.

- **Contributions elsewhere.** The subcommittee has complete data on all associations, charitable and other non-taxation charges against government contracts on which to weigh the extent there should be considered allowable costs. Attention was focused on this question during testimony by General, which developed that over a five year period the company has contributed \$620,443 to hospital, educational, recreation and various other organizations.

- **Kind of government facilities.** Policy on this has varied from McDonnell, which pays approximately \$500,000 a

year for use of government facilities to the other firms which pay only nominal rental. Although the industry has taken the position that rental is simply charged against contracts, subcommittee, against any doubt, with the lack of a uniform discount policy.

- **Private investment in facilities.** This is one of the most controversial points. McDonnell took the position that sufficient earnings should be allowed so that there could be complete private ownership. Herbert pointed out that the government should not turn over plants it has financed to private ownership.

- **Government "sidekicks."** The question as to whether the military services should "lead out" private aircraft companies with contracts was raised in connection with the Martin Co.

'Rescue' of Martin

In connection with the PGM Subcommittee report from Sen. of Aeronautics, which Martin was in deep company with Convair, Herbert attacked "It has been government business which rescued us, a private organization. There is nothing businesslike about it or illegal about it. It is the way we do business. But we shall have to let the policy as to whether the government is to continue under the five categories system to lead out private companies out for the profit of the individual company—but for the ultimate service of the country."

The industry generally was in the forefront of the hearings.

Fairchild's executive vice president, A. F. Flood, told the subcommittee that companies should be "non-restricted" instead of cutthroat for being restricted. He said they "help themselves" by showing that after a military contract, side offices "can command a position in industry."

Ex-Officio Salaries

Herbert charged that the salaries of military officers were "charged against contracts for which they did nothing." The officers and their non-military work.

- **Gen. Jacob Devers 1951, \$17,000, 1954, \$17,000, 1955, \$27,500.**
- **Brig. Gen. William Welch 1951, \$24,000, 1954, \$27,500, 1955, \$25,500.**
- **Brig. Gen. James Earle 1951, \$25,000, 1954, \$24,700, 1955, \$14,500.**
- **Major Gen. Robert Welch 1951,**

Industry Report on Salaries, Bonuses

Tables of salaries and bonuses totaling more than \$25,000 annually as reported by five aircraft companies in House Armed Services investigating Subcommittee on these figures.

Boeing Airplane Co.

Year Ended Dec. 31	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903	2904	2905	2906	2907	2908	2909	2910	2911	2912	2913	2914	2915	2916	2917	2918	2919	2920	2921	2922	2923	2924	2925	2926	2927	2928	2929	2930	2931	2932	2933	2934	2935	2936	2937	2938	2939	2940	2941	2942	2943	2944	2945	2946	2947	2948	2949	2950	2951	2952	2953	2954	2955	2956	29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\$10,000, 1994, \$11,000, 1995, \$15,000.

• **Adm James Tamm** (Doc), director for briefing \$15,000 over three years.
• **Adm Robert Casper**, newly retired Chief of Naval Operations, as a director has accommodations at \$15,000 a year, plus \$300 for each meeting attended.

Support of Bonuses

Boeing's president, William M. Allen, and Martin's president, George M. Bender, strongly supported bonus plans.

USAF's decision to double bonus costs, Allen said, "is not a justified position. It is being raised by the industry." I make the categorical statement that the application of our incentive plan has been a fair thing for Boeing and the U.S. Government." Bender declared that "a well-administered incentive compensation plan does result in better performance and higher efficiency and lower costs."

McDonnell's executive vice president, Robert H. Charles, pointed out that Congress should approach the matter of aircraft procurement "not from the standpoint that the industry's earnings, which have represented little more than two cents out of every available dollar, are too high, but from the viewpoint that the overall price, of which costs represent almost 90 cents out of the taxpayer dollar, can be reduced.

Charles told the subcommittee that if adequate test facilities were available to expedite the incorporation of changes in developmental aircraft, the taxpayer could be saved "millions of dollars each year."

No Tunnels Available

"Able from NACA research tunnels, in which there is insufficient time for development tests by industry, there are no tunnels available to us as capable of performing some of the larger supersonic tests we need to make," he said. "There are only three tunnels currently available to us: two supersonic test tunnels and one facility overcrowded that only a fraction of the testing required can actually be performed."

"Although these new government-owned supersonic wind tunnels would be available in the next three years, there will be no money more expensive research and research under development by them that the shortage will be even greater in 1999 than it is now."

Reporting that hearings on the PHN and P-301 program were delayed 48 months because of lack of facilities, Charles said these tunnels "would have been brought to completion years ago, and the development cost approach to building adequate facilities had been available."

These are details on firms developed

Atomic Box Score

London—The Manchester Guardian has work estimated that the United States has three times as many atomic bombs as Russia, and that even Britain "now has enough nuclear explosive in its possession to destroy every large city in the world and probably most of the large towns as well."

In an article by its scientific correspondent, the Guardian estimated the U.S. stockpile at 12,000 and said the U.S. has "probably at least 5,000 plus atomic bombs" from the Hiroshima, Nagasaki, and other atomic bombs 235 from Oak Ridge, Tenn. "to produce at least one bomb a hour."

It estimated the Soviet Union's stockpile at 10,000 atomic bombs "perhaps sufficiently large to make the military stockpile a large enough for all present and future military purposes."

The Guardian said Britain can make between 60 and 100 bombs a year from its plutonium reactors at Windscale, England, and produces enough annually 210 of Copenhagen, England, for 600 bombs a year.

"The military launch production of the USSR—the only other country which has gone in for this means of manufacture—has been certainly known, but probably more to the Americans than the British position," the Guardian said.

Neither British nor American government officials had any comment.

at subcommittee hearings. (For details on North American and Martin, see AW Feb. 27, p. 32.)

Boeing. Government sales accounted for 99.4% of total business in 1992, 99.5% in 1993, 99.5% in 1994 and 99.7% in 1995. Net worth increased from \$67.5 million in 1992 to \$119 million in 1995. Business of \$2.5 million were paid to 3,762 employees in 1992, of \$1 million to 4,482 in 1993, of \$1.8 million to 5,003 in 1994. The plant was suspended in 1995, after the Air Force failed to disallow such payments at contract cost.

Fairchild. Government sales accounted for 99.4% of total business in 1992, 99.3% in 1993, 99.4% in 1994, 99.6% in 1995. Net worth increased from \$21.1 million in 1992 to \$35.4 million in 1995. Profitable capital increased from \$14,328 in 1992 to \$7.5 million in 1995. Surplus returned increased from \$14.6 million in 1992 to \$21.2 million in 1995.

General. Government sales were 99.5% in 1992, 99.4% in 1993, 99.6% in 1994, and 99.8% in 1995. Net worth increased from \$12.8 million in 1992 to \$44.7 million in 1995. Surplus returned in the business increased from

\$22.8 million in 1992 to \$27.1 million in 1995. The company's bonus plan applied to over 11,000 in 1992, 1993 and 1994 and to over 17,000 in 1995.

McDonnell. Government sales accounted for 100% of business from 1992 through 1995. Net worth of the company increased from \$42.2 million in 1992 to \$24 million in 1995. Surplus returned in the business increased from \$6.7 million in 1992 to \$16.8 million in 1995.

Douglas. Government sales were 95% of business in 1992, 95% in 1993, 95.5% in 1994, 96.5% in 1995. Net worth increased from \$63 million in 1992 to \$134 million in 1995. Surplus returned in the business increased from \$51 million in 1992 to \$182 million in 1995. Government-owned facilities account for \$183 million, in cost, and company-owned facilities, \$39 million (\$67 million before depreciation after amort). The company plans to spend \$10 million of its own funds on facilities over the next five years. Military sales volume was \$449 million in 1992 (1.7% profit after taxes) \$770 million in 1993 (1.7% profit), \$734 million in 1994 (2.5% profit), \$773 million in 1995 (3.1% profit). Profit before taxes ranged between \$2.9% to 5.7% over these years.

USAF Missile Range Gets Radar Chain

A chain of 21 radar stations capable of automatically tracking a guided missile throughout the full length of the USAF's 1,500-mile missile range—from Cape Canaveral, Fla., into the South Atlantic beyond Puerto Rico—should be completed by early spring.

The \$39 million radar network, is claimed to be the "world's largest radar radar warning system" and to be capable of determining missile position to within 0.02 degrees, presumably by triangulation from radar data. The radar chain also can determine missile speed, velocity, and acceleration—data which is recorded and simultaneously transmitted to the central control center at Cape AFB.

The new system was designed and built by Raytheon Instrument Co., a subsidiary of Dynamics Corporation of America. It consists of dual radar in a 10-ft radius on each of eight radar ships along the range, plus six radars in two bits run for optical operations.

All are interconnected in a wide continuous surveillance in the missile passes along the range. The dual radar beams on each island provide redundancy as well as a means of double checking accuracy of the data on the radar.

The chain is now complete except for the installation of 30 lenses, and will be used for recent long range missile tests.

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and perfection is no trifle"*
Michelangelo



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New Matador For USAF

A new, improved version of Matador's Matador ground-to-ground tactical missile has successfully completed a series of test flights at the Air Research and Development Command's Holloman Air Force Base, New Mexico.

Designated the TM44B, the new missile carries a larger war section, probably its increased fuel capacity, than that of the present Matador. For tactical reasons, it also will be equipped with an automatic release system.

Production of the present line of the non-boost (over 600 mph) missile also will be continued under contract. The Air Force placed a new order for this version of the Matador under this contract.



B-47, B-50s Equipped As Hurricane Hunters

Three B-47 and two B-50s, will be equipped with the latest meteorological instruments and new classified Air Force mission equipment to add a Weather Bureau project to their usual cloud hunting and to respond forecasting techniques. The first mission aircraft as well as other interested agencies, as participating in the program.

General Electric Laboratory, Westinghouse, N. Y., will install the instruments under a Weather Bureau contract valued at more than a quarter of a million dollars.

Included will be the GPS developed AN/APN-53, an automatic radio beacon (radio beacon) receiver which automatically establishes aircraft position as well as wind velocity and direction.

Photo-panel recording will provide a continuous strip film photograph of 21 instruments, providing data on such

things as temperature, humidity, wind direction and speed, humidity, temperature, various accelerations, etc. (fold through, latitude and longitude).

In addition, most of the functions will also be recorded on digital form, and converted automatically into IBM punched cards while in flight. This will permit rapid evaluation of the recorded data as soon as the aircraft lands. The punched card data will be recorded in geographic records in the aircraft's flight.



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where the engine could explode on other life sources in the time.

In case of a short inside hit on the door, sensing devices within each pod automatically cause the pod to detach and descend by parachute to prevent the fire spread and consequent damage.

Design has developed Kinetics packages for external stores on QJ-17G and QJ-150 type destroyers using the zero-drawdown dimensions and maximum surface of the 14.5-gal. Fletcher drop-tail fuel tanks. Some weight is in the object in storage, the total weight has the scales at 750 pounds installed.

Refueling is reported to eventually high in the functioning of engine and wing system. However, failure in the communications which would trigger the warning and human crew in signal sending, have caused missile flights to go uncontrolled.

Certificates of Necessity

Materials, Inc., Phoenix, Ariz., has been awarded two certificates of necessity for military electronics facilities including 54,000 sq ft with 4000 sq ft for rapid air construction, by the Office of Defense Mobilization.

Other recent certificates are:

Whitcomb Products, Inc., 1750 West 10th, Seattle, Wash., 100,000 sq ft for military aircraft overhaul.

Seattle, Wash., 100,000 sq ft for military aircraft overhaul.

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FIRST PROTOTYPE of Martin XP6M, at left. A wing being mated. At right, SeaMaster hull carries into final assembly position.

P6M Airframe Built With New Approach

Baltimore—The major airframe of the Martin XP6M SeaMaster was built with a new approach to experimental aircraft production.

The result: A 150 cost saving over usual construction methods.

The second prototype SeaMaster is now nearing completion at the Martin Baltimore plant. Its flight test program will be deliberately delayed for installation of test equipment displacing that lost in the crash of the first experimental plane (AW Dec. 3, p. 3). The complete wing-laying and wing-to-body component was installed in the second plane, which will be removed to make room for the test gear.

New Production Concepts

Then, basic approaches, new to the bureau of experimental aircraft production, accounted for the cost saving. • Volume production was an integral design requirement in experimental layout and detailing of the airplane.

• Regular production channels were used for scheduling wing routine methods, regular production work and materials.

• No new tooling and equipment were purchased, except for one or two items that could not be repaired. The idea was to make do with what was on the line.

Chief feature of the probability planning, says Adolph Vitek, Jr., tooling manager for the project, is the assembly breakdown which makes it possible to assemble the hull in sections

instead of in a separate hull dock.

Although the first XP6M was actually built in such a dock, production models to follow will be assembled in movable sectional fixtures.

Extensive use of jigs and tooling in the design replaced the conventional use of machined fixtures, jigs and tooling out of bar stock. Many of the parts were designed to be made in the Martin factory which is equipped to make a few parts of a specific shape at low cost.

Wing Skin Problems

Wing skin for the SeaMaster was tapered and about the thickness of a sheet of tin. But it was too thin to be drilled normal to the surface of the thick structural skin. To do this Martin tooling engineers devised a bridge fixture for drilling and rearing the structure to about 100 ft long and 11 1/2 ft high.

Not specifications required the skin to be installed after drilling and trimming this added 100 tons surface area to be installed. An old insulating tank was painted and moved close to an overhead crane, on a specially shaped support to take the weight of the big tank. The insulating solution and the 500-lb skins. Process workers were seated on the crane, and the first work was in working job at far less cost than expected.

Scaling the winged wing fuel tanks was another experimental program. The final solution was a method of applying a double-thick film of DUC 801

solvent to joints and rivet holes.

The joint between wing and wing ribs is sealed with the usual kind of bolted fittings at the end of each of the six spars. Added strength is obtained by a longer and heavier post between the bolting wing skins. A wing root end joint was built to maintain the high stresses required in assembling the wing root structure and maintaining the close tolerances of the joints. Aerial contours of the wing were milled by a special contour milling attachment mounted on a planer. A tolerance was made on a left template of the aerial section and guided the milling cutter along the exact outline.

A portable milling machine was developed to cut the nose and groove joint after wing and wing skins were ready to be joined. The joint follows the contour of the wing skin and is reinforced by the rivets. Controlled by a follower cam on the contour precisely cut in the end gage.

Extrusions Used

Martin engineers specified extrusions for wing chord members and bulkhead girders. They had found that these shapes could be used with only a moderate amount of final milling to make the desired shape. Milling was done with the material in a soft condition, and the extrusion was then heat-treated.

For full strength, a technique developed by Martin engineers to remove distortion after the heat-treat and quench cycle was used for the first time.



WITH WINGS ATTACHED to hull, SeaMaster prototype is ready for final assembly position. Note A-119 engine in left background.

on heavy-section material. Vitek said the results were as successful as when the method is used with lightweight parts. About 80% of bond work after opening is saved by free-fall quench.

Jet engine nozzles of the SeaMaster, detailed by one engineer as having few design problems, were tested in the usual manner by building a plastic-filled physical model.

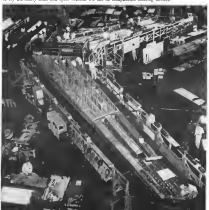
The skin design was the basis for experimental fabrication, but production wing design will depend to a large extent on the metal-form characteristics determined during prototype construction.

Inner and outer nozzle skins were Yoder laminated. Martin has used the low weight tool with active air seal to match contours of the rate and to make master models. Skins were joined at the leading edge of the nozzle throat.

Titanium and Honeycomb

Sheet titanium was to be used in brackets in the SeaMaster, and the decision to do so was made before there was much data available on the behavior of that new metal. Martin set up a comprehensive testing development program to determine optimum temperatures and pressures for working the material in bulk, Marlene said.

PROTOTYPE WINGS were assembled in single, horizontal fixtures which made it possible to lay the heavy skins and open without the use of complicated hoisting devices.



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GENERAL ELECTRIC

airbus market prices and stretch prices. More than 500 instrument detail parts are used in the SeaMaster, including a forward sheet built to 10 in. by 45 in.

Parallel to the developmental work on SeaMaster was a stretch program on existing. Week and no stretch plant had a minimum welding process in the Martin's work began. That company became the first aircraft manufacturer

to train certified welders to use commercially pure titanium. The Martin process was developed for specific conditions.

However, structures larger than steel were stainless-steel fabric of the XNUM design. Light bonded components use tin and rubber blankets, stainless blanket and chloride trailing edge, wing trailing edge and wing leading edge shut panels. Spokes, interior floor panels, engine work platforms and



WING for the SeaMaster prototype begins to take shape in Martin's horizontal fabric.



BRIDGE-TYPE FEATURE used for drilling and mounting SeaMaster wing skins.



SEAMASTER HULL DOCK. Production models will be built in postwar assembly facilities.

its circular escape chute are also bonded members.

Five steel structure sections were designed to use a large post-bonded sheet as main skin in which the honeycomb was placed and bonded. The outer skin was to be bonded to that structure, but necessary inherent in forming the outer skin were enough to knock out the chances of getting a consistent glass skin and a perfect bond.

Martin tool engineers developed a machining technique to level the honeycomb with the top of the pan to produce a uniform bonding surface. That method has since been replaced by a bond wire, cutting the honeycomb to length instead of the milling center of the convex method.

Plastic Tooling

Plastic materials were used for fixtures, wing tip forms, stainless-steel tips and tooling for both plastic and sheet metal parts.

Plastic tooling models developed at Martin made the nose cone, stabilizer tips and sheet metal wing leading-edge skins. Glass fabric skins used for fuselage skin, used for drill fixtures, trim line plates and check templates. Largest of these templates was used for trimming the wing root skins.

A finished open area for wing skin built for use on the engine test stand. The wing was 80 ft. long, seven feet wide and five feet high. It was formed over an integrative mold made of plaster, was made, cloth sheet metal and plywood. The mold could be ad-

justed for removal of the wing.

Production plans and tooling for the SeaMaster line is progressing. Viscous and five-bath systems are being found because of the honeycomb used during experimental planning and production which has revealed the transition from experimental to production fabrication of the SeaMaster.

Heat Stress Studies Use Special Ovens

Los Angeles—Internal stress analysis is being accelerated at Northrop Aircraft, Inc. to aid in design studies of future aircraft and in long-range inter-upter projects, says an official. Thermal problems of high-speed aircraft also are being investigated.

For determination of stress effects of high-velocity heat, the company reports it has designed new type of, stainless-steel stress oven. One type, a stainless-steel temperature oven, is designed to achieve very close control of inter-upter temperatures. It incorporates means for reducing temperature differentials in a specimen which can be maintained for extended periods of time. Some components must be heat soaked for two or three hours for desired temperature, definition before tests can be conducted.

High and quarter thermal lights also are being used for high temperature studies. Northrop reports that some studies will involve moderate temperatures of 1,000 and higher.



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Navy Contracts

Following is a list of unclassified contracts of \$25,000 and above as released in Navy Contracting Office.

CHARLES HOPKINS INTERVIEW, Test Monitor
Air, Philadelphia 11, Pa.

Aerial Monitor & Test Corp., 14-27-69, \$25,000.
To: Santa Fe, N.M., 14-27-69, \$25,000.
Contract No. 14-27-69, \$25,000.

Avionics, 14-27-69, \$25,000.
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Silicone News

FOR DESIGN ENGINEERS

SILICONE LAMINATED PANEL BOARD IMPROVES ELECTRONIC DEVICES

Based on Semiconductors and Field Insulators, Schenker's Well Surviving Corporation now uses a silicone-oxide laminate instead of bonded metal shoving and bonding laminates on the printed board material in many of their electronic as well as surviving instruments. There are some of the reasons for the silicone laminate.

Schenker's found that the silicone laminate has more uniform dielectric properties than other materials. It is also more resistant to moisture and has a higher dielectric constant than other materials.

The first effect was found during the development of the silicone laminate. It is also more resistant to moisture and has a higher dielectric constant than other materials.

Another important factor in the selection of silicone laminate is the high moisture resistance. Moisture absorption of silicone laminate is only 0.001% compared with 20% for the phenolic.

The silicone laminate is also more resistant to moisture and has a higher dielectric constant than other materials.

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ELECTRIC WHEELS IN HUGE "SNO-FREIGHTER" POWERED BY SILICONE INSULATED MOTORS

The many advantages of placing the power unit close to the work are being realized through the use of heat-stable Class II electrical insulating materials with Dow Corning Silicone. A recent example is the electric insulated motor in each of the electric wheels on the giant "Sno-Freighter" built by E. G. LeTourneau, Inc. of Groesbeck, Texas.

SILICONE VALVE LUBRICANT SEALS, PREVENTS CORROSION

In the process industries involving refineries, petrochemicals and plastic manufacturing plants, Dow Corning Valve Seal improves the performance and increases the life of valves handling a variety of aggressive chemicals and gases. Effective at temperatures from -100 to 500°F and highly resistant to many chemicals, this silicone lubricant provides a durable and airtight seal against leakage of process fluids, and protects valve stem against corrosion.

In fact, Dow Corning Valve Seal has proved to be dependable in such service that Trucon Valve engineers now offer their valuable low equipped seal on a standard valve and choke for replacing the valve lubricant. Excellent results particularly in reduced maintenance have been obtained with silicone lubricant.

The silicone lubricant is also more resistant to moisture and has a higher dielectric constant than other materials.

The silicone lubricant is also more resistant to moisture and has a higher dielectric constant than other materials.

The silicone lubricant is also more resistant to moisture and has a higher dielectric constant than other materials.

Long-term leader in the development of heat-resistant valve lubricants for construction and industry, the LeTourneau built the 274 ft overland train to provide winter-haul freight service between isolated sections of Alaska. Designed to hold in only six weeks, the train has a total capacity of 125 tons. Its engines have been designed to operate in the extreme cold temperatures of the Arctic.

The 274 ft overland train is provided with winter-haul freight service between isolated sections of Alaska. Designed to hold in only six weeks, the train has a total capacity of 125 tons. Its engines have been designed to operate in the extreme cold temperatures of the Arctic.

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Test seats, short ones, big ones or anything in between. They can suit a car, truck, or even a motorcycle. They can be used for testing and for seating and for testing and for seating.

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pletely ignores blinding snow, slick rain, ice-covered ice... per-
forms with flawless Gruen precision always! Stopping distance is

reduced as much as 30%...automatically! The pilot is free to
concentrate on other vital duties! Greater overall safety is assured!
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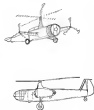




ZAGI 3-BA helicopter (Fig. 16).



ROTOR HEAD of 3-BA of 1930 (Fig. 13), ZAGI 3-BA PV top right (17), Olego 2 (15).



YURIEV prototype jet rotor pilot of 1924 (Fig. 14) and with rotor open (15).



ISACCO helicopter 4 built in 1935, not known to have been tested (Fig. 16).

Soviet Vertical

By Eugene K. Lifsonov*

The onset of the first World War and the subsequent revolution in Russia stimulated helicopter development during this period. The Russians were not alone; had been made in comparison with other nations. To the beginning of 1917, the year of the revolution, Russia had about 2,000 planes and less than 500 engines. About three-fourths of the designs were of French origin. In 1919, the air force was taken over by the Soviet Republic. In December 1918, the main aeronautical laboratory was re-established in the Central Aero-Hydrodynamic Institute (ZAGI) at Moscow. Amongst the engineers was A. N. Tupolev who was to make a name for himself as the builder of giant bombers. The laboratory is comparable to the NACA, but ZAGI also undertakes the development of new aircraft configurations including design and manufacturing of prototypes.

What a ZAGI designed is accepted for production in fabrication is passed on to one of the more production plants scattered throughout the Soviet Union.

Hence all ZAGI designed aircraft are experimental, existing primarily at the early helicopter built in the USSR. The various aviation institutes, which are engineering schools, have also produced aircraft prototypes

* Assistant Director of Engineering, Flight Research Agency.



OROBYSHEV Convergophase shown in Soviet patent 2193 (Fig. 17 left), Krasovder helicopter airplane designed in 1895 (18).

Flight Designs Keep Pace With West

which emerged as design problems for designers.

In 1925 helicopter research began in earnest at ZAGI. The director of this group was Tsiolkov. He presided until 1928 with the assistance of Prof. A. Cherenchukin and A. Iulians. Tsiolkov took over in 1937 when Yuriev was transferred elsewhere. These were the days of the great papers when more than one accelerated capacitor full out of favor with the NIKVD, the list also included Tupolev.

Other helicopter engineers at ZAGI were K. A. Borkin, D. I. Antonov, I. P. Butskanov, G. I. Solovov, V. P. Lopyrev, I. I. Nikolskiy, D. T. Morozov, B. I. Schukovskiy, M. S. Shkolev and A. A. Detskiy.

Consequently, another group was investigating the problems of the auto gyro.

Initial work at ZAGI consisted of auto configuration studies and ground wheel tests. The initial test investigated the characteristics of a two-blade centrifugal rotor of 24-in. diameter incorporating cyclic and collective pitch control. This type of control was not used for it dated back to before the first World War. The test stand was driven by a 120-hp M-2 engine rated at 1,750 rpm. The M-2 was the Russian version of the nine-cylinder Gnome rotary of French origin.

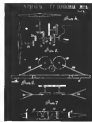
That the Russians were no further ahead in solving helicopter problems than were other nations is evidenced by an entry on the state of the art in 1928 written by Iulians and Cherenchukin



TATARSKEYEV Aeromobile project (19).



KARANDINA autogyro (Fig. 20).



DETAILS, Krasovder design (21).



ZAGI 11-4A convergophase, 1935 (22).

All the methods of helicopter rotor action tested, single or principle, are difficult to carry out in practice, even more expensive for aircraft installation. Similarly the construction of apparatus for automatic clutching, alteration of speed, transmission, etc. is complicated that up to the present no reasonable solution of these problems have been found."

In 1930 the first ZAGI helicopter appeared. It was designated ZEA (Zemlepolnyy Apparat). This apparatus-craft carried a single fuselage, wing rotor and two aerodynamic rotors, one forward and one aft on the fuselage (Fig. 16). The rotor had cyclic and collective pitch control (Fig. 17). The pilot's control was an extremely simple mechanical device to the cockpit.

It was reported in 1931 that the first flight related to Professor Cherenukhin flew in an altitude of 535 feet and remained in the air for 12 minutes. In August 1932, the helicopter was reported to have flown to an altitude of 2,000 feet. In descending the craft went out of control resulting in a crash. (These early Russian flights were never homologated by the I.A.I. the best contemporary I.A.I. records were 55 feet altitude and an endurance of 10 minutes.)

This helicopter was unable to develop control during the period 1930 to 1933 under the supervision of Lukash.

The ZAGI ZEA was similar to the ZEA. The following performance was claimed: Maximum speed, 18 mph.; range, 100 miles; maximum altitude, 400 ft.; endurance, 10 to 15 minutes.

The ZEA was a design by I. P. Borishkin under development during the period 1935 to 1937. The craft had single or blade lifting rotor. These of the blades, 10-14 feet in diameter, were fully articulated. The other three were 15-6 feet in diameter and featured variable pitch control. The ZEA configuration was similar to the other models, the two rotors on the fuselage being oriented. The pitch change mechanism in the rotor head was developed by Yuriev. All these early machines displayed poor flying qualities.

The IIFA was a convertible type with a lifting rotor and tractor screws. This configuration will be described subsequently. A further test version of the craft was built in the late thirties. It was designated IIA VAP. The IV added to the model designation indicated propeller, served. A smaller propeller was used. This machine resembled both the wing and blade because a propeller configuration (Fig. 21). The propellers, associated with the project were D. I. Sushkov and V. P. Lipnev. The IIA VAP was the forerunner of the much perfected Omega helicopter (Fig. 14).

Design on the Omega was initiated

in 1939 by I. P. Borishkin, and the machine was first flown in 1941 by K. F. Ponomarev. This appears to be the first successful Russian helicopter. The craft was a lateral rotor helicopter with propellers mounted outboard on outriggers. The engine was M-11, which rated at 115 hp each. Design values for the helicopter were 112 mph maximum speed and 1,100 ft. max. climb rate of climb.

The Omega was first publicly displayed at Tikhomir Artyukhin's Moscow on Aviation Day, August 15, 1945. The craft was awarded the Stalin Prize and went into production at Plant 52 at Tikhomir. The Omega was followed by a larger and improved version also designed by Borishkin. This machine was designed to carry a crew of two and six passengers. The 600 hp ASh-21 screw-driven rotor engine was used. This version had no necessary rotor which enabled the rotor.

The latest helicopter in the Omega 3 is a 24-passenger machine. This helicopter is in the prototype stage.

Pressure-Jet Design

In 1924 Yuriev obtained Soviet patent no. 781 for a pressure-jet rotor helicopter. Fig. 14 is a reproduction of the patent abstracts. Several variations are shown. The basic design is a pressure jet helicopter. Yuriev identified the cycle in the Bernoulli turbine cycle. Pressure was obtained by an engine-driven compressor or a centrifugal compressor as the rotor blade, gurnel in the rotor. Fuel jets are located near the blade tips. Yuriev visualized the use of pressure jets in the region of the blades.

In the same year Yuriev was granted Soviet patent 1,576 for a vertical helicopter (Fig. 15). Each rotor was driven by a separate propeller mounted on the fuselage frame. The multi-rotor, Russian, was for safety reasons obtained by reduction in the diameter. One of the novel features of the device was a variable thrust, one half mounted on the pilot's stick. Via turn of the stick regulated the speed of the rotor.

N. I. Korovin was another pioneer who conceived active rotor. The Soviet regime. His plan was an important part in aviation development in Russia, and his early work on helicopters dates back to 1923 when he was engaged in a jet rotor project. In recent years Korovin produced the K-17 emergency control rotor helicopter mounted on a Bu-2. The propeller was a modified Palmer-Dunne multi-blade design of 14 blades, length of about 17 ft. The Russian named this craft "K-17" which means "vertical lift."

Yuriev became one of the world's foremost helicopter pioneers. During the twenties and early thirties he con-

structed helicopters in France and England. [The design of the "Omega" multi-motor powerplant showing propellers Advantages claimed for this arrangement were the elimination of a transmission, and the attainment of greater stability. In 1932 Yuriev was called to Russia to head a joint helicopter of his colleagues. The machine was constructed in Moscow at the Civil Aviation Institute under his direction with A. Lukash, a prominent Soviet aviator. The machine was completed in 1935 after three years work.

The Helicopter No. 4, as it was designated, had 144 hp twin-cylinder engines and propellers and a tractor engine propeller and mounted in the nose of the fuselage (Fig. 16). The top propellers were 120 hp and the modified Gipsy 5 engines. Each rotor weighed about 150 lbs. The main engine was a 90 hp. Weight total. The same was 90 feet in diameter and the flying weight of the machine was 7,000 lbs.

These characteristics yield a climb of 1,000 ft. per minute and a power loading of 1.8 hp. per horsepower. The resulting figure of merit is .485 based on power to the rotor only. Inconceivable to build the up but the flight test program was to be carried on the basis of the Russian. In 1935 he was given what in the U. S. would be known as "the heavy rule" and he left the USSR. To this day the designer does not know the fate of his machine.

In 1935 Yuriev had built no model in building near helicopter. For many years he remained his home in Paris where he carried out research in the development of a submarine, with his company, rotor blades.

The most recently published helicopter has been that of M. E. Mil. During the twenties Mikail Mil was one of the designers who performed as a designer in development of the ZAGI. The "Mil" helicopter is intended for military use. The craft has a three-blade fully articulated rotor incorporating feather dampers. The diameter is 44.5 feet. This helicopter was publicly displayed in Moscow on Aviation Day 1951.

Russian Claims

Soviet writers have often made strong claims about Russian aircraft. Some of their claims are included here.

The USSR Information Bureau says: "The first flying helicopter was developed in the Soviet Union by Yuriev and his students. Yuriev and Borishkin have found the correct form of the helicopter and have eliminated the danger of rotor which hitherto have been faulty and, therefore, unable to build the machine in the air."

In an article in Gipskiy, B. 12

The helicopters below represent the helicopter night of the Soviet today. Behind their designs is 200 years of Russian research on vertical aircraft.



DUBSA TWIN ROTOR helicopter designed by Borishkin in 1939 is displayed at Tikhomir in 1945. Design was awarded a Stalin prize.



HOUSH is demonstrated in 1933, resembles Mikail N-7 design in production.

HARE was first production version of Mikail Mil design, was flown in 1951.



KANOV Vertical is first model order for communication and rescue duties.

HOUSH is first rotor helicopter. Its design has been credited to 310 by Soviet publications.

100

Avien's 'piggy-back' thervel switch



adds
positive level control
to any fuel gage

Avien's piggy-back thervel switch is the development of several fuel management systems — new logic, impedance, fuel level control to any fuel gage installation.

Employing Avien's proven thervel switch in a new clamp-on design, the "piggy-back" sensor mounts on any tank, pipe — gas line, water, tank, sequencing and other fuel management jobs. External relay unit controls moving parts from the tank, remote vehicle control of signal lights, pumps or valves.

Measuring less than 6.5 pounds, the "piggy-back" Thervel Switch uses only four wires between units in addition to any fuel system without altering present equipment. Just insert — operation is independent of fuel gage circuit, providing positive level monitoring even under emergency conditions.

Additional features

- Operates from standard 24 volt DC supply
- Buffers by shock, vibration or acceleration
- Requires no additional wiring
- Inhibits no additional wiring
- Inhibits no additional wiring
- Inhibits no additional wiring

Other Models Available in 12 volt and fuel gauged models, as well as special designs.

For complete specifications and application data write Dept. 8-20

Avien
Precision Instruments and Control Systems
121-12 Madison Blvd., Norwalk, CT, U.S.A.

flow, the affected area for maintenance was limited and when the Mustang instructor Capt. Antonio II discovered the machine, and submit a report. Tatumson, grounded for eight months, time but the Mustang had caused the machine was "technically repaired."

On August 22, 1969, Minister of War Sukhomlinov and a technical group control the instructor Tatumson, as, about the contract was cancelled and he was ejected from the "practical article." Sukhomlinov, serial during the early days of the first World War had had the deathly destruction of being accused of espionage by his own government.

Tatumson decided to continue his work, without official assistance and found several supporters. He transferred his location back to the property of Tatumson. Again lack of money prevented him from completing his machine.

He was "banned" to the village prison for taking to prison the hopes shared in his. On one of his days, Dec. 4, 1969, Tatumson was in action.

"Heard" by the press, Tatumson suffered a psychic disturbance under the influence of which Tatumson, at first, to my emergency laboratory, began, and had destroyed all the apparatus contained therein. All his achievements and resources perished in the fire.

A Soviet investigator, present was T. S. Shumakov, a lieutenant in the blue finance department of the Taganrog military plant.

He proposed a machine, consisting of two lifting screws, a track, ground by and water. The machine included the control plus of the, anticipated machine.

I was a man without wealth, as completed a machine at the plant. I had no funds available for transportation, have just barely enough from one pocket to the next. I most humbly request a series reply, the fullest proof of what is true or what should be delivered. If I do not learn this from you, then one will be closing a door between me, a Russian, and other Russians. "This closed the door."

Soviet Conventions

The earliest conventional design under the Soviet regime was a proposal by V. V. Droboshev. The craft was disclosed in Soviet patent No. 1,991,171. The construction featured a tubular wing, engine and rotor system. For control the rudders were mounted on the upper surfaces of the wing, as the rotor system and rotors were located at the end of the wing. Figure 4 is the patent drawing shows the control system with the wing control.

Another Soviet conventional design was G. G. Kromden. The craft is described in Soviet patent No. 2,075,000, applied for in 1974 (Fig. 20, 21). The design consisted of a single lifting wing and a fixed wing. A tractor propeller could also be fitted. The wings were driven by a gear transmission system. The wing was formed of separate rotatable surfaces which could be turned 90 degrees to permit air to pass through it.

During 1975, KAGI had an active conventional patent for the VFA (Fig. 22). This machine used the same rotor system as the VFA and included a fixed wing with two tractor propellers. The rotor had a maximum diameter of 9.4 feet, and the rotor blades had a diameter of 30.2 feet. The machine was designed to take a 600 hp Gervin Compressor engine. At an engine speed of 2400 rpm, the rotor turned 333 rpm. A scale-down experimental version was built which showed the VFA-FV helicopter. The propeller screws were removed, but the wing was omitted.

The most recent Soviet helicopter was built in the Soviet Union. This conventional aircraft project was active in Russia is evidenced by the reports of the wide spread usage reported on some Soviet aircraft.

(This is the second of two articles by Mr. Tatumson on the project of Russian helicopter design.)



F-100C Stabilizer at GAC

Goodman Aircraft Corp., Alaska, a product of various aircraft such as the Boeing-Stabilizer for the F-100C Super Sabre under subcontract from North American Industries, Columbus, Ohio. Other aircraft included in the subcontract are vertical stabilizers, engine wing leading edges and data. Production is expected to cover through 1977.

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Bayer Aircraft Finds:

USAF Conversions Mean Big Business



AIR FORCE B-50s line up for modification that will shift them for training purposes.



PARKED B-50s inside Haco's Birmingham plant await conversion to their post-bombing.

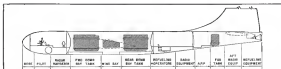
Birmingham, Ala.—Haco Aircraft Corp. will under way on its contract to convert Boeing B-50 bombers into B-50D three-point refueling tankers for the United Air Command, is confident it has found a new opportunity in the aircraft business.

Leon J. Joffe, Haco's president, told Aviation Week that his company looks upon the tanker contract as proof that "there is a spot between the prime contractor and the central shop" where no operation such as his can find many opportunities in the future. Joffe has numerous agencies he backs up in claims. He estimates 1956 sales at Haco will run to \$99,500,000. The operation was started in 1951, when sales were \$700,000. The firm has been steady since sales in 1955 were \$19,500,000.

Major changes in the Haco operation took place last July 1, when the plant became a private industry. Prior to that, it was a U. S. Air Force Contract Aircraft Division in the Birmingham Modification Center and under the control of the Mobile Air Materiel A/C.

1,000 B-25s Modified

The contract with USAF made the Haco plant available for continuous modification or rebuilding of aircraft. Work was started in August of 1941 on the North American B-25 and more than 1,000 of them have gone through



CONVERTED B-50s will carry fuelage tanks in both forward and rear fuselage tanks. A third fuselage tank is located in the center.

the Haco shop since. In addition to the regular B-25 (disposition and its use as "Navy's" work, those aircraft have received various modifications, such as the addition of new B-25's, conversion to a completely redesigned electrical system.

Joffe emphasizes that Haco engineers have done all of the modification work, including the design of the B-25 for changes the USAF can make in the field. It is clear that this type of job led Joffe to accept what he considers a new and specialized market for the Haco plant and capabilities.

"We have" he said, "built because the prime designer for the B-25 as it was in 1941, North American, manufacturer of the bomber during World War II is out of the picture except as a source for some spare parts. The remaining planes are used for training missions, and the design team is changed from B-25 to B-25L."

More R&D Expected

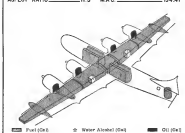
Joffe stresses his effort to build up the Haco company's preference in engineering. He looks upon the conversion of the B-25 as one that will result in increasing amounts of research and development work, much of it aimed at improvement or modification of existing USAF equipment. The B-25 contract is an example. Other conversion projects include development contracts in the electronic field connected with improvements in the Boeing B-47 and B-52 jet bombers.

Until major Haco job done by Haco has been the Fairchild C-119. In this case the modification engineering was done by the prime contractor and the Haco job has been largely one of conversion. There are 14 C-119s possible delivery in a C-119 first has been in service and Haco inspectors must check each one of them.

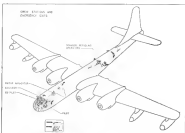
As Haco and others are used to record the defects and deliver each aircraft through the shop. This makes possible accurate cost studies, with one central possible in total number of aircraft by virtue of the line, by systems in the assembly and by individual jobs.

Work, cost and quality control are

WING AREA _____ 1720 SQ. FT. WING SECTION _____ BOEING 117
ASPECT RATIO _____ 11.5 M.A.C. _____ 134.41"



SCHEMATIC shows equipment area that will be used to house fuel in tanker version of B-50.



B-50 has crew of five: pilot, copilot, navigator, engineer and two fuel operators.

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For The Full Story On Your Ohio Future, Write Today: Mr. J. W. Papp, Personnel Manager, Department 56A.A, North American's Columbus Division, Columbus 14, Ohio.

integrated into a single IBM package. According to Peller, the Air Material Command feels that one of its best values is that each time they save \$100,000.

Birmingham Owned Plant

The Hayes plant at the Birmingham Airport is owned by the city. It was used during the war for modification of B-24 and B-29 bombers now in a bad state of repair when Hayes took it over in 1951 with 22 acres of the soil now in completely deteriorated. The plant has 3,485,000 square feet of floor space, stands on a lot of 291 acres. There are more than 5,000 employees.

The work on the B-29 contract, under way for almost a year, there are two 40-foot-high bays, each with 110,000 square feet of floor space. The work to be done on each bomber constitutes a major rebuilding of the aircraft.

The B-29 will be the first three-point probe and check before production quantities. In the test section and pools under each wing tip. Hayes will install such and shapes designed by Flight Research, Inc. This will be specially controlled by operators in side bays at forward stations.

Naval jets will include pilot cockpit, radar scanner, flight engineer and the new command and control. Low prototypes can be tested on testing or form assembly. Minimum gross weight will be 173,800 lb.

Fuel Tanks Added

A total of 7,720 gallons of fuel for transfer will be carried in seven tanks installed in the bomb bay, wings and pylons. In one, an emergency with flow of fuel can be diverted from the aircraft's main system. The planes' fuel tank system has been redesigned to provide power for the fuel pumps and pump system. It now can deliver 400 gallons per minute at 100 psi, with 500-gallon capacity. A new lighting system is being installed to facilitate refueling operations at night. The fuel tank of the wing fuel and bomb bay tanks will be dismantled and a new one located on top of the central stabilizer will be usable for 50 miles.

New radio equipment has been selected to meet the needs of the ground communication transmission between crew stations, no optional radio installation and be used during emergencies. Just as the electrical system is the largest of its type ever designed or installed in an airplane, the communication equipment is a wide range.

It includes VHF, UHF and HF systems. The VHF system is the largest of its type ever designed or installed in an airplane, the communication equipment is a wide range.



Steps up gear blank production 300% by switching from bar stock to TIMKEN® steel tubing

AN engine manufacturer felt that his gear blanks were costing him too much to make. The center hole had to be bored out of solid bar stock. It took a whole hour to turn out 29 blanks. And a lot of steel was wasted in the process.

So the manufacturer discussed his problem with members of the Timken Company, experts in this alloy steel. After study they recommended a change in production methods together with a switch in Timken® seamless steel tubing in place of bar stock.

With Timken seamless steel tubing, the center hole is already there. It doesn't have to be bored out. Finish

boring was the engine maker's first production step. And with Timken steel tubing his gear blanks are now being turned out at 120 to 150 an hour—an increase of 300%.

Machining costs have been cut by more than half. And because the center hole is "built-in", no steel is wasted.

The list of the Timken Company covers records of hundreds of problems that have been solved by Timken fine alloy steel. If you have a tough steel problem, why not bring it to us? Write, write or phone The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMKENCO".

STEEL TUBING — TIMKEN EXPERIENCE AND RESEARCH



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COLUMBUS DIVISION



Boeing engineers find rewarding jobs in Wichita, Seattle

This model of a supersonic airplane design is displayed at a recent visit from a B-47 designer. Taken from the right, the characteristics of an airplane flight to destination at the early stages. This is just one example of Boeing's continuing development of all related aircraft and associated systems components.

At Wichita research and development program are expanding rapidly. Laboratory space has been quadrupled and more when new engineering facilities have been added to keep pace with increasing emphasis on technical development. At both of the company's plants, Seattle and Wichita, the increased scope and magnitude of this development effort is creating additional and excellent career opportunities for all types of engineers.

This means that if you are an electrical engineer, a mechanical engineer, a civil

or an astronautical engineer or a physicist or mathematician with an advanced degree there is a real challenge for you in one of Boeing's design research or production engineering programs. You would work in a high level research environment, a place of honor for skill, experience and recognition.

Boeing engineers are making new airplanes, airplanes and rockets that will maintain the standard of technical achievement established by the B-47 modern bomber, the B-52 intercontinental bomber, the KC-119C military transport, the KC-119C military transport and the KC-119C military transport.

Recognition of professional growth is coupled with career challenge at Boeing—where the company is at the peak of World War II. This gives a most ideal career plan. You would join the

company's career path with the peak of the engineering profession. There will be one waiting for you in the program's career path at Wichita or Seattle.

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Boeing Airplane Co., Dept. 6-11, Wichita, Kansas
JOHN C. LUTHERS Staff Engineer—Personal
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If you want to be an engineer in the same way as a career with Boeing, please send me a copy of the above information.

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tion leader, radio altimeter, long-range navigation equipment, ECM and radar. For maintenance, the KB-50 will have diagnostic equipment, supplemented by radar and the UHF direction finder. Hydraulic systems, separate from the aircraft's main system, are being installed to operate the fuel pumps during transfer in motion. Quick disconnect couplings will permit removal and jettisoning of the bomb bay tank without lifting it into the hydraulic system.

For this project, Haves has built a test facility to evaluate fuel and hydraulic systems. It is capable of measuring fuel flow up to 2,400 gallons per minute, pressure drops and the efficiency of the hydraulic system. Fuel control tests can be given at temperatures to 70 degrees below zero. Hot fuel, life cycles, surges, contamination and boundary factors can be measured. Standard weight and balance tests can be held. A chemical and materials laboratory and an electrical, radio and environmental laboratory support the facility.

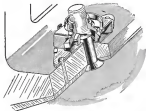
Jeffers feels that the KB-50 project contains an entire weapon system in all its phases, including as it does design and development, flight and laboratory testing of components and the complete aircraft. The company's future, he told Aviation Week, a lead in working more closely than Birmingham's plant for the project, where the project 5,600-ft runway are expected to expand soon to 8,700 ft. Haves has had opportunities to work on modern aircraft that cannot test the field. In one case, significant work was to be done for a project involving the B-47 modern jet bomber.

The company's experience with B-47 and modification work on the B-35, B-37 and other transport and bomber types has shown, however, the importance of maintaining schedules. Aircraft sent to Birmingham by a USAF command are repaired for a limited time and the work required must have three weeks to meet commitments.

Quality control standards, according to Jeffers, should get much of the credit for keeping things on schedule. For checkout on a C-54 or B-35, USAF now gives a flight test to only one or two aircraft in any case. The last flight, Jeffers says, the quality control program shows results. As experience shows that quality standards are kept high, the flight test can be given to only one or two, then one in an aircraft. Each test flight eliminated from the Air Force about \$500.

For the future, Jeffers counts on further development, including improved engineering capability. He is pushing Haves into as many fields as possible, adding ability in the fields of design, manufacturing, maintenance and completion of technical data.

FASTENER PROBLEM



Unique fastener for simplified method of bolting non-parallel surfaces

Aircraft construction is making increasing use of large forgings and rolled skin construction. The increased strength provided by this type of construction has greatly reduced mechanical costs and airframe weight. However, such pieces are often tapered in two or three planes. Attaching sheetmetal skin to a tapered forging or attaching a tapered, rolled skin to another member creates an extremely difficult fastening problem because both head and nut seating surfaces are not parallel. Present alternatives are to machine each of the bands of fastening points to assure parallel seating of the nut, or the base of the nut must be built up by tapered shims, hand selected for each location to correct for the changing thickness and angle of the outer surface. Both are costly and excessively time consuming solutions.

ESNA's new self-aligning nut solves the problem efficiently and economically. It is riveted to the structure as simply as any other nut but has. The several rows of nuts are riveted inside the bracket permit the full strength bracket to automatically compensate to angular bolt installation up to 8° in any direction. This new nut has been designed as a two lag nut and illustrated (Type LAG2000) in great detail from (Type LAG2000).

The nut is available in carbon steel for moderate temperatures and in stainless steel for elevated temperatures up to 800°F. It meets MIL Specification for nut and washers. Like all ESNA's nuts, it is vibration proof and reusable many times.



Type LAG2000

MAIL COUPON FOR DESIGN INFORMATION

Electric Shop Not Corporation of America, Dept. NPS-102
2220 Vancleave Road, Newark, New Jersey

Please send me the following free literature information:

☐ Bulletin on self-aligning nut ☐ This is a drawing of my product. What self-aligning nut would you recommend?

Name _____ Title _____

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CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION
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PRODUCTION BRIEFING

► **Reflexions Devices** has been established in a new operating unit of Corning Glass Works, Corning, N. Y. Principal products of the new division in addition to conventional reflexions, will be special high temperature reflexions for rocket nozzles and other specialized applications using new materials developed in the company's extensive research laboratory.

► **Electronic equipment** and technical service contracts received by General Precision Laboratories, Paramusville, N. Y. Over \$500,000 in flight recorder installation ordered by Office of Naval Research, Special Devices Center, Ft. Monmouth, N. Y. \$272,000 from USAF for services on AN/APN-41, AN/APN-66 and AN/APN-62 radar receiver sets, a contract from Dayton AF Depot for countermeasures and overhaul of AN/APN-62 equipments.

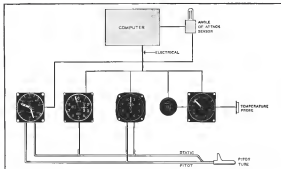
► **New quarters** of 75,000 sq ft have been taken over by Blumens Manufacturing Co., at 31st and Oxford Sts., Philadelphia, Pa., for its government research and development department. Work includes metal forming aids and weapons systems.

► **General Corp.** has received a contract for three WV-2 precision trainers from Navy's Special Devices Center for instruction of pilot, co-pilot and flight engineer. The WV-2 is a Super Constellation Navy order pocket plane.



BEAL AND WHEE HUSH combination clock indicator and receiver dimensions indicating hours, date and time, to provide positive clockwork operation, to be used in aircraft structures. The dial is attached to a standard wire brush. Ship work is made by Glenn L. Martin Co., Baltimore, Md.

EQUIPMENT



INTEGRATED FLIGHT INSTRUMENT SYSTEM schematic shows computer and electrical link that assures high instrument accuracy.

DC-8 to Get Integrated Flight Package

By George L. Christian

Elkhart, N. Y.—A new flight instrument package, called the Integrated Flight Instrument System (IFIS), has just been chosen by Douglas Aircraft Co. for its DC-8 jet transports.

Now in prototype production at Kollsman Instrument Corp., IFIS has also been ordered by at least two airlines for their new jets, American West has learned.

All the basic flight information the pilot needs is presented in five basic instruments: altimeter, indicated air speed indicator (which also shows maneuver, maximum and most economical speeds), true air speed indicator, Mach number indicator, and true outside air temperature indicator.

"The system is designed for use on all types of high speed aircraft" according to Victor E. Kollsman, Kollsman's president.

"It will provide pilots with the most complete and reliable flight information available to date to help them solve problems of altitude separation, cruise control and navigation. IFIS will substantially increase flight efficiency and safety and reduce the work load on

flight crews of high speed aircraft," Kollsman says.

Electronic Integration

Philosophy behind Kollsman's new flight instrument system is to take well tried, acceptably accurate, pure pressure instruments and integrate their outputs electronically and work on a common computer.

This feature is said to correct for inherent errors in the instruments and systems themselves. Result: When electrical portions are functioning correctly, very accurate data presentations are obtained. True 50,000 ft altimeter is claimed to be accurate to ± 50 ft at sea level and ± 100 ft at 40,000 ft. Important safety feature of the entire IFIS package is that if the aircraft's electrical system should fail, all pressure instruments will continue to function. They give today. The altimeter runs, for instance, because it is IS.

System Integration

Here is how Kollsman integrated the various IFIS components to produce the accurate readings it gives flight crews:

• **Altimeter readings** are corrected for

angle of attack, Mach number and various atmospheric errors.

• **Minimum indicated air speed** is defined in single attack.

• **Minimum IAS** is defined as a function of altitude.

• **True outside temperature** is obtained by correcting static temperature with a function of Mach number.

• **True air speed** is computed from true outside temperature and Mach number.

The electrical components which interface the various pressure instruments with each other and with the computer are standard, service-proved Kollsman units such as the Standard

Altimeter Detail

Looking a little more closely at the altimeter (left) used for the airport indicator and Mach meter is not an easy job on high speed aircraft. Installing the static probe on a long boom projecting far ahead of the plane in its perfectly all-prototype accuracy usually gives the best results. But such a location is impractical for production craft because it can interfere with non-aerodynamic radar, necessitates the planes hold length unnecessarily and is vulnerable to damage.

Standard, subsonic-speed location,



1,000 knots at 20,000 feet...

yet brilliantly sharp, crisp photograph

1,000 knots at 200 feet...



Chicago Aerial's IMC makes it possible

IMC means better Motion Compensation... the synchronization of film with flight movement of image. At all speeds, any altitude, Chicago Aerial IMC equipment now provides vastly superior photographic definition. Discussed by C.A.I. has produced not only reliable IMC equipment, but has also pioneered the *Shower System*—an electronic rain which scans the surface before and recognizes true-speed altitude ratio. Automatically, film breaks outside film movement in a camera to compensate for forward flight motion even at tremendous speeds. Rier becomes a thing of the past... replaced by sharp photographic definitions.

This electronic-mechanical-optical system assures unrestricted performance in our superlative reconnaissance planes. Another example of C.A.I. advanced research and production.



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such as wing airfile tips often cannot be used on planes exhibiting at Mach 1, because shock waves rippling on these areas, making static sources unreliable.

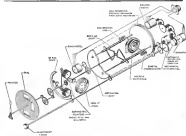
No location of a static source, no fast static source is determined unambiguously. Since the two parameters which affect a static source are Mach number and angle of attack, its location becomes more difficult as planes become both faster and bigger.

In places its faster. Although location of a static source was chosen for a given Mach number, the plane's speed came above and below this figure, accurate and static error is, because, significant. As jets become faster, and the wing shape changes from straight to leading-edge airfoils, the location of the static source changes because of the great quantity of fuel consumed. Changes in angle of attack will become correspondingly larger also inducing error in the static source system.

To trace these compositional errors, Kollsman engineers allow the inaccurate static pressures to reach the altimeter instruments to make the corrections there. The altimeter's angle of attack, and Mach corrections are fed into the static



QUADRUPLE-INDICATING air speed with error (shown) device contains altimeter air speed (shown) pointer, indicated air speed (shown) pointer, indicated air speed (shown) pointer, and altimeter air speed (shown) pointer. Scale ranges from 0 to 300 knots in increments of 100 knots. Note dual barometric scale altimeter (below) has zeroed down indicating 1,000 ft. static pressure for 200 ft. static.



SCHEMATIC of Kollsman's new, down-type altimeter shows pressure-operated components and integration of electronically-driven controls to increase the instrument's accuracy.

ever constant section of the computer unit. The angle of attack transducer and Mach number meters show dimensional error. Error can read off the surface of the case and are fed to a differential Synchrostat in the altimeter scale error corrector and thence to a Synchrostat in the altimeter.

The scale error correction, one each for the pilot's and copilot's altimeters, are, according to dual carry the same total number as their respective altimeters. Within the units, each adjustment provided at 2,000-ft. increments, wipe out "badging" altimeter error.

The conversion error is made in modules and is housed in computer unit.

Baldwin Watch Co. is tooling up for production of sensitive altimeter, developed by Kollsman Engineering Corp., which is used to have an accuracy of one part in 5,000 throughout its operating range (AWD Div. 5, 1955, p. 26).

To make the altimeter case to read, a single needle indicates altitude in thousands of feet, with one full revolution representing 1,000 ft. A barometric scale indicates altitude in thousands of feet. Instrument recognizes a dual barometric scale calibrated both in inches of mercury and millibars.

In a single unit, the pilot's case and a plane's altimeter altimeter speed as a stepped pointer, indicated air speed as a plane pointer and cross reference and altimeter speeds as an index which rotates around the outer rim of the instrument's dial.

Leutnering designed the altimeter pressureless speed at which a given type of aircraft may fly in the form of selected air speed, Mach number or

equivalent air speed. The maximum speed varies with altitude. Therefore the instrument contains a special altitude displacement which permits the stepped, maximum speed needle in the air speed indicator.

The indicated air speed pointer is actuated by the pilot barometrically stepped displacement and is connected by the same angle of attack probe which serves the altimeter. Maximum speed index is also operated by this probe.

During approach and landing, pilot can tell at a glance how far he is above landing speed by noting the distance between the 145 needle and the maximum speed index.

Two of these new air speed indicators are now being on USAF B-47 and now are planned for an additional 50 aircraft, according to Kollsman spokesman. (The angle of attack probe is made by Spectraflex, Inc., AWD Div. 5, 1952, p. 49.)

To correct the instrument type outside air temperature compensation for lateral heating at high air speeds (speed of 470 knots produces a 15F heat rate to true outside air temperature), the dual temperature is combined with a function of Mach number. This true temperature and Mach number are then used to compute true air speed, which is presented on a small, digital counter.

Both true air speed and outside air temperature readings can be fed into remote, shielded electronic units.

Added feature desired for IFPS is that the Stratospheric low-pressure low-stress impactable loads as instrument mechanism, thus do not affect their accuracy.

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Weight Saved in New Self-Contained Mount

A shock mounting to protect jet engines and missiles during transportation and long-time storage is being developed by Leland Aircraft Products.

Because the unit is a self-contained structure, it can be used without the usually heavy engine or missile combination and still provide complete shock protection, the company says. Complete mounting for a modern turbojet weighs less than 260 lb.

Mechanical Mounts is also producing a low-vibration suspension system to protect delicate Navy electronic gear which may be subjected to rough treatment, such as truck-mounted roller or equipment to be shipped long distances.

Suspension design incorporates preloaded springs to eliminate resonant frequencies and vertical shocks to support sides of the equipment.

The unit protects the large electronic cabinets from distortion and damage. The base springs are designed to be used for permanent installation or long-term storage.

The company says that Radio Shack, division of Radio Corporation of America, has tested the suspension system with good results. Some 500 units have been delivered to Radio Shack, and Navy's Bureau of Ships has ordered another 136 such systems. R. F. Applegate, Mechanical Mounts' president, says. The company's address: Box 45, Ellettsville, Ind.

Quick-Folding Seats Designed for Viscount

New aircraft seats which can be quickly folded against the side of a fuselage to make room for cargo, are going into mass production of Short Brothers and Harland Ltd. Viscounts, which will be used by BEA's Viscount 620 fleet, will will feature 90, come in 60-in. double and 90-in. triple units. They incorporate safety and emergency features on their backs.

Douglas Will Favor Low-Power Avionics

By Philip J. Klaus

Avionics engineers and manufacturers are being offered an attractive financial incentive to reduce the electrical power consumption of equipment designed for high-speed military aircraft.

Douglas Aircraft Co. studies show that every single watt of electrical power consumed by avionics equipment in military aircraft now equates design increases in costs by nearly \$20. Douglas is prepared to put a premium for reduced power consumption, taking this factor into account when comparing the price tags of competitive avionics equipment. S. A. Carhart said at the recent Institute of the Aeronautical Sciences meeting in New York. Carhart is a design engineer in the El Segundo plant.

The growing cost and difficulty of getting out of fuel generated by avionics equipment in expensive aircraft is behind the Douglas "effort." Since the problem is not unique with Douglas, low power consumption can be expected to be an important consideration with other military avionics suppliers.

This could put low power consumption on a par with equipment performance, weight, size, and light weight in deriving factors in selecting avionics equipment.

The Douglas figures also provide added incentive for low-powering avionics equipment, despite the higher initial cost of installation.

It is generally recognized that the substitution of transistor for tubes cuts power consumption by a factor of 10 to 20.

AVIONICS

Carhart's figures are based on the fact that to sustain high performance military aircraft, approximately 10 pounds of avionics are required for every pound of payload. With avionics costs running above \$40 per pound, the "growth factor" of 10 means that every extra pound of avionics, or equipment required to power or cool it, costs about \$400.

The Douglas studies indicate that a unit costs \$6,200 per lb., or about \$6 per watt, to generate constant-frequency a.c. power in a high-speed jet designed for a two-hour mission, such as the A-7D. This is based on an assumed weight of seven pounds per lb. for the alternator and constant speed drive, plus an additional eight and a half pounds of extra fuel required per lb. during a two-hour mission to drive the alternator and make up for drag loss resulting from cooling air required by the alternator, Carhart says.

Multiplying by the \$400 per pound figure, this results in the \$6,200 per lb. figure cited above.

Cooling Costs

The use of an amplifier-recycle cooling system, operating bleed air from the engine, is adequate for cooling avionics equipment designed to MIL-E-5400 as an airplane whose speed ranges from about Mach 1.2 to an air level to Mach 1.7 at 35,000 feet, Carhart says.

Carhart figures the cooling costs of the single-stage recycle cooling system as follows:

- 15 lb. of cooling equipment per kilowatt

• 100 lb. of heat to be removed from avionics equipment.

• \$7.75 per lb. of extra fuel expended for extra lb. of heat removed. Using the \$400/lb. figure, this means that it costs \$31,500 to dissipate every kilowatt of avionics heat, at \$12.93 for each watt.

When this figure is added to the cost of generating the electrical power, the result is \$39,800 per kw., or \$19 per watt.

For aircraft now under design, which will fly at Mach 2 spends at sea level and Mach 3 at 35,000 ft., the single-stage recycle cooling system will not be adequate, as the same figure shows.

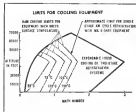
Rather than resort to a two-stage system, avionics manufacturers probably will use liquid oxygen and a heat exchanger for cooling, since the oxygen is needed for crew breathing. The only limit on the capacity of this type of system is the amount of liquid which can be carried, Carhart says.

Sensing Problems

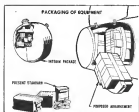
The use of refrigerated air for cooling "has had a noticeable effect on the arrangement of avionics equipment within the combat aircraft and on its accessibility for maintenance," Carhart said in the IAS.

Where compartment temperatures must be below that of the cooling air, very little leakage into the compartment must be tolerated.

For example, at Mach 1, a 1-in. diameter hole in the avionics equipment compartment can result in a leakage of 0.875 lb. of air per second, the



TOUGH AVIONIC COOLING PROBLEM, shown in curves (R), may lead manufacturer to locate all avionics in a single case package (P).



AIR TRANSPORT



NEW YORK AIRWAYS' Sikorsky S-55 hoists to serve Hudson area. George Washington Bridge en flight from Lufthansa to Newark.

Helicopter Line Sees Profitable Future

Subsidy-laden New York Airways hopes to near break-even point by 1960 with new routes, aircraft.

By Gloria Gershen

New York-New York Airways, still subsidy laden and operating with stopgap equipment, hopes to near the break-even point by 1960 and consider the potential of its helicopter franchise "the most valuable in the world."

Availability of profitable equipment to

about 1960, along with the "pioneering" of the building corridor above the roads for connecting helicopter services, are the major factors the airline believes it needs to achieve domestic independence.

The young airline, meanwhile, has carved from a standing start (which it began operations in October 1959) its

1955 traffic total of 23,907 passengers, 1,412,167 lbs. of mail, 1,965,120 lbs. of express and 471,785 lbs. of freight. This year promises to be an even better one in several aspects, according to Glenn B. Eastburn, president of the parent.

Among them:

- At least three 12 passenger Sikorsky S-55 helicopters will go into the scheduled airline's intrastate and suburban service; each with more than double the capacity of the present S-55.

Interline agreements with all major airlines and up to 15 carriers serving the New York airports will begin to go off during 1959.

Helping Problems

Another problem, but one now being dealt as continuously, is service into midtown Manhattan (NW Feb 27 p. 100).

The big question of whether New York Airways can begin operating into Manhattan may be answered within the next few weeks. If the answer is yes, then the Port Authority granted local helicopter pilot, airline and S-55s equipped with parachute gear plus a hoist into the air for a month or two. During this period it will cover such mail and get the airport board experience it feels it needs.

Then it will begin serving passengers from the midtown strip to the airports and, if it demands its "pioneering" connecting airport into the suburban communities. Long-range plans call for additional helicopter conversions to

West Strick and to replace Manhattan. Along with the helicopter cost, the airline has had other problems.

Among them has been its struggle to win the support of the Port Office Department, its agency Eastburn says. "That has not been particularly helpful." The Port Office failed to support the airline's application for a certificate last year it was awarded in 1952, the department provided the mail that brought in the only revenue cargo until January 1957.

At that time, New York Airways became the world's first scheduled helicopter airline after converting cargo helicones. New York International, LaGuardia, and Newark Airports now serve to 11 communities, terminating at Bridgeport, Conn.

From there, New York Airways went on to extend its routes into New Jersey, add night flights and become faultless (July 1957) the world's first scheduled passenger helicopter airline.

Personnel Growth

From one to 55 at the beginning, the carrier slowly built its fleet to the present 64, plus a third place Bell 4731 it uses for charter work as return for providing maintenance for the owner.

The original New York Airways staff of three pilots, four maintenance men and about seven others including President Robert Cummings and Eastburn, has grown to about 100 people, and reported revenues for the first 11 months of 1958 totaled \$1,996,000, of which \$3,314,132.29 was Federal subsidy.

Startling equipment, of course, has been a major problem from the beginning and probably will be for some time. The airline's fleet of 64 S-55s, of which 53,314,132.29 was Federal subsidy, is a multi-engine aircraft powered 70-horsepower (NW May 25, p. 107)—is available New York Airways will be "upgrading" a schedule line operation. The S-55s will help maintain growth but they also are classified as stopgap equipment.

Official Indifference

Another hurdle has been the "indifference" of officials in some communities, according to Eastburn from eastern promotion manager for the Los Angeles Chapter of Commerce and a leading force in keeping helicopter service to that city.

He feels that American communities generally lag behind their European counterparts in this respect and cites the especially generous help from the British in that area as an example.

Opposition from some civic groups, who feared the noise and loss of reliable rail service, developed in some communities even before New York

Always began serving them. But once the service was established, the complaints generally became negligible.

Eastburn says plans to build "an transportation center" to link major cities, such as New York, with the world's airlines is now under discussion with the federal government. That the federal buildings of these centers would include parking facilities for all airlines, with passengers being brought to and making that connection via helicopter.

USAF Traffic Control at Langley Withdrawn Following Near-Miss

Washington—Civil Aeronautics Administration withdrew its plan to withdraw its traffic control authority previously delegated to the U. S. Air Force to operate a Radar Approach Control Center (RACON) for both civil and military aircraft in the Langley, Va., area. The withdrawal order followed a head-on collision of a private Cessna 441 and a military C-119 at Patrick Henry Airport, near the RACON facility.

The CAA action was taken on Feb. 25 and was precipitated by a near head-on collision of two commercial aircraft on Patrick Henry Airport less than 24 hours earlier. It also represented action to a series of complaints against the RACON system, claiming that the RACON system had delegated authority to the Air Force in the Langley area on Feb. 1, after rigorous objection from the air transport industry. In the meantime, the CAA also announced its intention to withdraw its authority to the RACON system at the Air Force, near the Westover AFB, Mass. The Westover RACON began Feb. 10 and the CAA RACON system was withdrawn, but without notice on Feb. 15.

The shutdown of the Langley RACON was recommended by the Chief of the Norfolk CAA center and was fully implemented in CAA headquarters Washington. Both CAA and the Air Force have initiated a full scale investigation of air traffic control activities at Langley. Special interest is being shown in the Feb. 27 near-miss accident.

The reported near mid-air collision happened at night and involved a Capital Airlines DC-4 (Flight 457) and Piedmont Airlines DC-3 (Flight 34). Both flights were using instrument flight rules (IFR). Piedmont's aircraft was on a scheduled flight, while the Capital DC-4 had been cleared for take-off and was approximately 2,000 feet off the

believe that the helicopter carrier's short-haul "bait" of the total revenue from such services could be damaged potentially small. Eastburn feels that the long-haul airline should pay the major share of the costs for the helicopter. New York Airways is a large left defense in 15 miles.

Working out further arrangements with the long-haul carriers is needed, Eastburn says, to establish the proper costs of the helicopter concerning service to the total pay cost.

was a plane the Piedmont DC-3, with an approach clearance, was circling in a holding and passing directly over the DC-4. It was elevated the two planes passed each other with a vertical clearance of approximately 100 feet.

It was reported that Capital's flight was a scheduled flight from the Patrick Henry tower that a second flight was in the immediate vicinity. The tower operator's report indicated contact was made with Piedmont's DC-3, which reported a RACON clearance. But said later was the tower informed by Langley AFB RACON that a Piedmont flight was coming in.

The withdrawal RACON situation has been controversial since its inception. CAA has not had the necessary funds to build and maintain its own equipment as it had not effectively allowed to Air Force personnel for military RACON operations for certain post-war military uses. CAA is known to have more than 100 military aircraft, was first delegated that as the first "military" CAA would remain its basic structure authority for air traffic control. The Langley incident has already caused CAA to undertake a review of its proposed policy of delegating its responsibility away.

CAB Launches Vigorous Program on Near-Misses

Washington—The Civil Aeronautics Board has launched a vigorous program for the collection of information so-called "near-misses" or near-collisions in the air.

To encourage voluntary pilot reports of near-miss incidents, CAB issued a Special Civil Air Regulations (SR-416) offering immunity from prosecution or disciplinary action for violations. The board has determined a new report form that can be submitted immediately. CAB and the need for a data program was centered in the increasing frequency of near-collisions.

United Had Record Year in '55; Prepared to Meet Jet Age Needs

United Air Lines carried more passengers and took more money last year than ever before. The company expects its financial position is stronger than it was in 1954 and it is ready to meet the needs of the jet age.

Substantial gains in traffic, revenue and profits in 1955 are shown in United's annual report to its stockholders. The airline said it is accelerating its overall program of preparation for introduction of the jet age in 1958, when the DC-8 is scheduled last year are scheduled to go into service.

The report shows that at the end of 1955, United's financial position was stronger than it was the previous year. The airline's cash and working capital position was maintained in the face of debt reduction and down payments on jets which together totaled over \$18 million.

Last December, United arranged for \$110 million in new issues to be sold during the next five years—\$50 million in long-term debentures, \$30 million in long-term notes and \$30 million in short-term notes. Debt outstanding at the end of 1955 was \$33,554,000.

Revenues Up 17%

United's revenues increased 17% to \$235,573,000 last year. First class passenger revenues rose 17% to \$152.9 million, and coach revenues gained 19% to \$58.4 million last year.

Expenses originated increases slightly in 1955, showing an 18% increase. United blames this on the costs of increasing capacity 16% in terms of available take-offs and increased costs because of equipment which now are in 1954.

The airline's total depreciation expense rose from last year's \$23,995,000 in 1954 to \$21,204,000 last year as some airplanes became fully depreciated. At the end of the year, United had fully depreciated 78 DC-6s, 14 DC-7s and 15 DC-3s.

Net earnings for the year were \$11,244,077, compared with \$10,177,604 in 1954. United's profit margin of 4.5 cents in net earnings per dollar of revenue rose from the same in the 1954 level.

Traffic Matches Revenues

Traffic increases matched gains in revenues. Passenger miles rose 19 percent, freight ton-miles 15%, mail ton-miles 31% and express ton-miles 21%.

The passenger load factor moved from 66.8 in 1954 to 87.7 last year. The cargo traffic, measured in ton-miles, rose 15 percent. Coach passenger miles increased 14% while first class traffic

went up 14%. Coach represented 35% of United's total passenger-miles last year, compared with 29% in 1954 and 23% in 1953.

United will receive 10 new Douglas transports this year and 27 in 1957. These deliveries will increase available seat miles 19% this year and 14% next year.

Question an Irregular

In the report, the company stated that the industry is growing and will continue to grow at a rapid pace, but United feels the growth is irregular because current to offset rising costs and rising fuel costs. United said the report cannot be accomplished if traffic is a small too thin.

United also questioned the recent Large Airplane Decision reached by the CAB last year. The airline feels that the authority granted in the decision "posed an important question as to the worth of freedom enjoyed by those who, over the years had purchased the industry and its good times and bad, and built it to its present status."

Along with its turbulent past, United said it has studied the technology field through and will not continue there is a present regime adequate to power the type of plane which would suit its specifications.

Passenger's Predictions

The report and United anticipates that medium-range turbo-prop aircraft will be needed to supplement the long range turboprops.

Estimating future growth of the industry, United forecast 23 billion passenger-miles in 1960 and 36 billion in 1965 compared with about 20 billion last year.

In a speech before the Transporters Air Association at American in Chicago last month, United President W. A. Patterson predicted similar growth for the industry while forecasting a 27% decline in surface passenger-miles in 1965.

Patterson pointed to the jet as a key factor in keeping traffic within growth. He told the group that the jet transport will have a longer life in the

air transportation picture because it works a slowdown in the short-term cycle that has shortened the life spans of past aircraft types.

The IATA president predicted that the fastest transport will be a 15 to 20 year airplane. Patterson agrees that speed has been the main factor in making people expect aircraft obsolescence and that the jet has reached the peak of the obsolescence cycle. He said he did not think the body in the industry is going to wait about purchasing the same better commercial.

It is relative to the coming jet age, Patterson said that the data which manufacturers could be persuaded that they need a new airport are gone. He pointed to the delay of their airport bond issues in Los Angeles in evidence and said "We see the handwriting on the wall. We recognize it and we know that we have to build airports to fit the airport rather than the transportation building airports to fit the airport."

CAA Sets Standards For Arresting Devices

Washington—Civil Aeronautics Administration has approved standards for installation of runway arresting devices on civil airports. The approval covers the two types now used by the military, spring-energized barrier and tailhook cable.

The Air Force was an assisting body which consists of cables which extend to about 30 inches above the runway. The cable is attached to each end of the runway and is held in place by the tailhook cable.

The Navy uses a cable held in place by the spring, which is held in place by the tailhook cable. The cable is attached to each end of the runway and is held in place by the tailhook cable.

CAA said that to date there are only two airports for military use. Installations have been proposed at some 25 additional locations.

The new CAA rules governing all airport installations require:

• Minimum standards for installation are not to be applied to civil airports.

• They must be installed in the same way when there is sufficient length at the end of runway.

• Barriers installed within the limits of the runway must have all impact absorbers fully grade except the spring and arresting cables, which be fit on the runway surface.

• Barriers will have to be removed at all times, except when military aircraft are being landed on the runway.

Two "saves" of military planes have been recorded at civil airports by the few devices installed so far, CAA said.



New Terminal for St. Louis

The modernistic \$7,215,000 airport terminal building shown above will be formally dedicated this week at St. Louis' Lambert Field. The terminal, featuring a rolling steel-type roof and weather glass walls, covers about 100,000 square feet of floor space.

Los Angeles to Enlarge Airport System to Meet Expected Growth

Los Angeles—In the face of an estimate that annual air passenger traffic at Los Angeles International Airport will increase by about 30 million passengers in 1970, officials here have set up a task force to study ways to enlarge the airport terminal and runway system for the years.

Under projected plans to cope with present and future airport capacity needs of Los Angeles and vicinity, a proposed \$59,700,000 bond issue will be submitted for voter approval here June 5.

The bond issue, if passed, will be used for airport expansion and expansion of International Airport and San Fernando Valley Airport as a second facility for the Los Angeles metropolitan area and for expansion and development of airports.

Under the improvement and expansion plan a new east-west runway, 5,400 ft long, would be constructed at International Airport, four miles north and parallel to the present runway (see story). Plans would also be to build a new runway and take off on the new runway, increasing the airport's capacity from the present 44 to 50 take-offs and landings per hour to 120 per hour, at one landing per minute and one take-off per minute.

Both runways would be lengthened when necessary.

Between the two runways, a new terminal complex would be constructed in a rectangular pattern. This would include passenger terminal buildings to be linked to auditorium, concession buildings, aircraft parking aprons, approach

and access road systems, public transportation, maintenance and storage areas and customs and immigration areas.

Decentralized buildings and mobile land operations are the basis for the terminal design.

Decentralization permits each section to operate as an independent unit and allows for orderly expansion for future years.

The field level would be used by the planning personnel, the second level would be used by operating personnel, and at this level, an enclosed concourse would extend around three sides of the terminal.

On each level, there is a space for 155,000 sq ft. of space for surface area and the area has been divided into 14 separate units, seven on each side of the rectangular terminal layout. Space on each level is expandable to 311,000 sq ft.

A third level at each end and in the center of the rectangular pattern is near the interior of the terminal area. The end units will be devoted to shops and stores, while the central unit would provide occupancy for telephone and telegraph services, a wireless theme, women and children's department, police quarters etc.

A fourth level above the end units will house main restaurants and retail shops.

Escalators, elevators and stairways are located to provide convenient access to all levels.

The terminal aircraft parking aprons are designed to accommodate 66 gate

positions. There will be an access passenger concourse—three on each side of the terminal—leading to the gate positions. Expressions capabilities exist for two additional concourses surrounding 15 more gate positions. Each concourse will use the mobile gate positions and present no interference with two levels of fixed wing planes.

On the field and second level of the terminal, there is space for 7,554 cars. Parking lots outside the terminal complex will handle another 5,591 cars. A shuttle service is planned from the outer lot to the terminal.

The existing passenger terminal will be converted to an air freight terminal and used terminal to meet the needs for expansion at these activities.

Plans for airport expansion and expansion of the San Fernando Valley Airport include clearing of approach and peripheral areas, construction of new runways, 6,000 ft x 8,000 ft, and construction of a 1,000-ft lighted landing strip.

Runways would be widened from 90 ft to 75 ft to permit parking of small aircraft, landing in side or opposite direction.

Highway runways are proposed at two locations to clear the runway in more rapidly.

On the field, 15 ft high landscaped and planted windbreaks will create a small buffer for the run.

The plan also provides for expansion of land at San Fernando Valley Airport to afford necessary storage for a high port passenger parking and business aircraft hangars and to be done soon.

The program also provides for a system of heliports linking sections of Los Angeles to the airport. In helicopter service, Downtown and East Los Angeles, Hollywood, the harbor and two or three points in the San Fernando Valley would become heliport stations.

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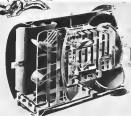
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